Empirical analyses of airport efficiency and costs: Small regional airports and airport groups in Europe

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Abstract

Small and regional airports often have insufficient revenues to cover their costs due to limited traffic and given minimum fixed infrastructure requirements. The question is how such airports could be efficiently structured and managed and financially supported in order to survive. Some airports are operated individually and receive direct subsidies from the local and federal governments. Others, mainly those belonging to national public corporations such as AENA in Spain, Avinor in Norway and DHMI in Turkey, which operate the majority of airports in the country, survive through cross-subsidizations. Furthermore, subsidization of air services through Public Service Obligation (PSO) in order to assure the mobility of people to and from remote areas also includes a subsidy element for the airports in term of landing fees, which they otherwise would not receive.

This dissertation first deals with the efficiency of 85 small regional European airports for the years 2002-2009 by applying a bounded measure of data envelopment analysis. Estimates show the potential savings and revenue opportunities to be in the order of 50% and 25% respectively. It is also noted that belonging to an airport system reduces efficiency by about 5%. The average break-even passenger throughput over the last decade more than doubled to 464 thousand passengers. However airports behaving efficiently could have covered their annual operating budget with a mere 166 thousand passengers annually.

The second part of the dissertation addresses the comparison of airports belonging to two airport groups AENA and DHMI for the years between 2009 and 2011. The majority of airports operate under increasing returns to scale. After presenting the similarities and differences of two institutions, a Russell measure of data envelopment analysis is implemented. Our results indicate higher average efficiency levels at Spanish airports, but recent private involvement enhances efficiency at Turkish ones. Certain policy options including the application of airport-specific aeronautical charges, a greater decentralization of airport management and the restructuring of the airport network (by closing some inefficient airports) should be considered to increase the airport system's efficiency in both countries.

In the final part of the dissertation, we have studied how the airport specific characteristics drive the unit costs. In order to capture the spatial interdependence of airport costs, a spatial regression methodology is applied. Two separate datasets of subsidized French and Norwegian airports are used to test various hypotheses. The results show a negative effect of subsidies on airport cost efficiency. Furthermore, the significance of scale economies is illustrated.

Keywords

Small and Regional Airports; Airport Groups; Data Envelopment Analysis; Spatial Regression; Efficiency; Costs; Subsidies

Zusammenfassung

Kleine regionale Flughäfen leiden oft unter begrenzter Nachfrage sodass sie angesichts der minimalen fixen Infrastruktur Anforderungen und unzureichenden Erlöse nicht ihre Kosten decken können. Die Frage ist ob solche Flughäfen zum Überleben effizient strukturiert, bewirtschaftet und möglicherweise finanziell unterstützt werden können und ob die Art der Subventionierung die Effizienz des Flughafenbetriebs beeinflusst. Viele solcher Flughäfen werden einzeln betrieben und erhalten direkte lokale oder nationale Subventionen, während andere von den Quersubventionen nationaler Flughafenunternehmen leben, die den Großteil der Flughäfen eines Landes betreiben (wie zum Beispiel AENA in Spanien, Avinor in Norwegen und DHMI in der Türkei). Zudem gibt es auf unrentable Strecken die Subventionierung des innergemeinschaftlichen Flugverkehrs, um die Mobilität von Menschen in und aus entlegenen Regionen zu gewährleisten. Solche Flüge werden als Public Service Obligation (PSO) auf solchen Strecken deklariert. Von den dadurch zusätzlich entstandenen Landegebühren profitieren die regionalen Flughäfen ebenfalls.

Die Dissertation befasst sich zuerst mit der Abschätzung der Effizienz von 85 regionalen europäischen Flughäfen zwischen den Jahren 2002 und 2009 durch Anwendung einer „*bounded measure*" der „*Data Envelopment Analysis*". Unsere Schätzungen zeigen, dass die potenziellen Einsparungen 50 % und gesteigerten Einnahmemöglichkeiten 25 % betragen. Die Zugehörigkeit zu einem Flughafensystem reduziert die Effizienz in der Größenordnung von 5 %. Das durchschnittliche Break-Even Passagieraufkommen hat sich im letzten Jahrzehnt mit 464.000 Passagiere mehr als verdoppelt. Die Flughäfen hätten ihre Kosten mit allein 166.000 Passagiere decken können, wären sie effizient betrieben worden.

Der zweite Teil der Dissertation beschäftigt sich mit einem Vergleich der zwei nationalen Flughäfengruppen AENA und DHM für die Jahre zwischen 2009 und 2011. Die Mehrheit der Flughäfen arbeitet unter zunehmenden Skalenerträge. Nach der Vorstellung der Gemeinsamkeiten und Unterschiede der beiden Institutionen wird eine „*Russell measure*“ der „*Data Envelopment Analyse*“ durchgeführt. Die Ergebnisse zeigen höhere durchschnittliche Effizienz der spanischen Flughäfen. Aber ein in jüngster Zeit verstärkte privates Engagement steigert die Effizienz in den türkischen Flughäfen. Wir schlagen verschiedene wirtschaftspolitische Optionen vor um die Effizienz zu verbessern, wie zum Beispiel die Anwendung von flughafenspezifischen Flughafengebühren, die Dezentralisierung von Flughafen-Management und die Verbesserung des Flughafennetzes durch die Schließung ineffizienter Flughäfen.

Im letzten Teil werden die spezifischen Eigenschaften der Flughäfen untersucht, um zu erklären, wie diese die durchschnittlichen Kosten beeinflussen. Durch eine räumliche Regressionsmethode konnten wir die räumliche Abhängigkeit der Kosten erfassen. Zwei separate Datensätze von subventionierten französischen und norwegischen Flughäfen wurden verwendet um verschiedene Hypothesen zu testen. Die Ergebnisse zeigen eine negative Auswirkung von Subventionen auf Kosteneffizienz der Flughäfen. Darüber hinaus wird die Bedeutung von Skaleneffekten veranschaulicht.

Schlagwörter

Kleine und Regionale Flughäfen; Flughafen Gruppen; Data Envelopment Analysis; Räumliche Regression; Effizienz; Kosten; Subventionen

Preface

My first visit to an airport was in Istanbul, when I was six years old. I felt privileged, because I was able to enter some areas of the airports, where the ordinary passengers cannot. My parents were both working for a ground handling company and I had the possibility to have regular visits to the airport for around ten years. The ground handling company was then privatized and my parents acquired their prior work positions at other public institutions according to the privatization law in Turkey. My parents did not believe that privatization was a good idea, perhaps because they lost their jobs, which they wanted to retain. When I think about this story nowadays, I can imagine that the privatized ground handling company was looking for cost saving opportunities starting with the employees in order to operate in a more cost efficient manner.

Then, I was then a regular airline passenger until 2007, using the airports for travel purposes until I became a member of German Airport Performance (GAP) Project at Berlin School of Economics and Law. One of the first research articles I read dealt with airport benchmarking and had a peculiar and challenging title: “Apples and oranges: Can benchmarking provide accurate and consistent measures of airport productivity and efficiency?” (Morrison, 2007).[1] He delivered an elaborated critique of airport benchmarking by frequently citing the ATRS (Air Transport Research Society) global benchmarking report. He argued that benchmarking of airports is not a comparison of apples to apples and the results should be interpreted with caution because of the sensitivity of results due to variables, assumptions and methodology. Adler et al. (2008)[2] published a response to this article, in which they provided explanations of their benchmarking analysis, as well as for airport benchmarking in general.[3] Having read both sides of the discussion, I believed that benchmarking

[1] Morrison, W.G., 2007. Apples and oranges: Can benchmarking provide accurate and consistent measures of airport productivity and efficiency?, Wilfrid Laurier University, Waterloo, Canada.
[2] As the members of the ATRS Global Airport Performance Benchmarking Task Force
[3] Adler, N., Oum, T.H., Yu, C., 2009. A response to 'Understanding the complexities and challenges of airport performance benchmarking'. Journal of airport management 3 (2), 159–163.

delivers decent and valuable results, but also accepted the challenges mentioned by Morrison.

More importantly, during my research on airports, I realized that two aspects play a very important role to enhance the contribution of the research. First one is a very detailed understanding of the data as well as the ability of collecting all relevant additional information on airports, so that the results have applicable managerial implications when running the airports. Second one is the link between the results of the analysis and economic policy, so that they can be evaluated from a total welfare perspective for the whole society and contribute to the overall well-being.

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First of all, I would like to thank Prof. Dr. Jürgen Müller, who enabled my research on airport economics by introducing me to the German Airport Performance (GAP) Project in 2007 as a student assistant. He always supported my work and created numerous opportunities for me.

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I am thankful to Prof. Nicole Adler for encouraging me to write a dissertation and for giving me the chance to collaborate with her on this research. I also thank Dr. Ekaterina Yazhemsky and Dr. Vahidin Jeleskovic for their collaboration in various chapters of this dissertation.

This dissertation would not have been possible without the joint data collection of my fellow students at GAP project. I am grateful to each of them. My special thanks go to Vanessa Liebert, Branko Bubalo and Eric Tchouamou Njoya for the long-lasting joint work on data and appreciated discussions. Further, I thank all participants of various GAP and G.A.R.S. workshops, in which I received valuable comments on the previous versions of the papers that make up this dissertation.

I owe to my parents for expanding my horizons and for their endless support. Finally, I owe to my wife Monique for her endless patience in the process of writing this dissertation.

Berlin, 2014

List of Abbreviations

ACI	Airports Council International
AENA	Aeropuertos Españoles y Navegación Aérea (Spanish Airports and Air Navigation)
AIC	Akaike Information Criterion
AIP	Aeronautical Information Publication
ANA	Aeroportes de Portugal, SA (Airport Authority of Portugal)
ATC	Air Traffic Control
ATM	Air Transport Movement
BAA	British Airports Authority
BAM	Bounded Adjusted Measure
BCC	Banker-Charnes-Cooper
BOT	Build Operate Transfer
CCR	Charles-Cooper-Rhodes
CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DHMI	Devlet Hava Meydanlari Isletmesi (General Directorate of State Airports Authority of Turkey)
DMU	Decision Making Unit
EAS	Essential Air Services
HIAL	Highlands and Islands Airports Limited
IRS	Increasing Returns to Scale
LCC	Low Cost Carrier

LFV	Luftfartsverket (Swedish Civil Aviation Administration)
LP	Linear Program
MAG	Manchester Airport Group
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PAX	Passengers
PPP	Public-Private Partnership
PSO	Public Service Obligation
RAAP	Regional Aviation Access Program
RAM	Range Adjusted Measure
RM	Russel Measure
RTS	Returns to Scale
SBM	Slack-Based Measure
SFA	Stochastic Frontier Analysis
STOL	Short Take-off and Landing
TFP	Total Factor Productivity
ULC	Urząd Lotnictwa Cywilnego (Civil Aviation Authority of Poland)
VRS	Variable Returns to Scale
WLU	Work Load Unit

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Chapter 1 - Introduction

"Regional airports provide their catchment areas with access to major cities and other major regional centres. This facilitates out-bound and in-bound tourism, personal and business travel, personal and business freight and importantly facilitates access to community services not available in the regions such as education and health services." (Hudson Howells, 2012)

Thus, factors other than economic considerations play an important role in the provision of airport infrastructure as far as the regional policies are concerned. These facilities contribute to the well-being of society from a number of aspects such as social, cultural, educational activities or quality of healthcare. Further, airports enhance the economic situation of the region by providing opportunities for various activities such as tourism, business or freight.

On the other hand, these airports frequently suffer from limited traffic, fixed infrastructure requirements and insufficient revenues to cover their costs. Thus, financing small regional airports is an important topic, which requires an in-depth analysis with all merits and limitations. Financial support is frequently necessary in order to ensure sustainable operations at these airports. Moreover, the organizational structures and management strategies of small airports differ from those of large airports and hubs. Considering the governance structure, various options exist and are applied differently in different countries. Public ownership remains dominant for small regional airports across Europe, due to the limitations in profitability levels. Yet, public ownership takes different forms including the federal, regional and local governments or local authorities such as Chamber of Commerce. Moreover the level of private involvement differs as well. On the one hand a public-private partnership (PPP) between the government and the private firm is implemented, where joint ownership and management of the airport describes the governance structure. On the other hand, entire ownership and management rights are delivered to the private firm with no public sector involvement remaining. Beyond that, whether strategic and managerial decisions are made centrally for a group of airports or individually for each airport describe the organizational structure in a country. The decision how airports are managed also determines the approach to cover the financial losses via subsidies.

This dissertation deals with the following aspects in order to provide recommendations to airport managers, airport operators, civil aviation authorities and governments in terms of key managerial and strategic decisions:

- ✓ *Estimating relative efficiencies of regional airports across Europe*
- ✓ *Determining the similarities and differences of airport groups*
- ✓ *Analyzing efficiency changes over time*
- ✓ *Examining reasons for poor performance*
- ✓ *Determining the break-even point of airports*
- ✓ *Defining the cost structure of small airports*
- ✓ *Finding the effects of subsidies*

1.1 Methodology

1.1.1 Data Envelopment Analysis (DEA)

Since the introduction of the CCR-DEA model by Charnes, Cooper and Rhodes in 1978, a large number of various specifications of the DEA has been developed and frequently applied. One of the most important reasons behind its popularity is its ability to calculate the relative efficiency of DMUs without determining a-priori functional relationship of the production process. Moreover, the DEA makes it possible to utilize multiple inputs and multiple outputs. Application of the DEA has included a wide range of areas from private firms to public sector companies or even to cities or countries.

DEA is a non-parametric linear programming approach, which determines the relative efficiency of decision making units (DMUs) through an analysis of multiple variables defined either as inputs or outputs. DMUs are assessed on the basis of a weighted sum of multiple outputs divided by a weighted sum of multiple inputs, without describing the production function directly. This non-parametric approach solves a mathematical model per DMU with the weights assigned to each linear aggregation producing the solution to the model. The fractional programming of the CCR-Model, which evaluates the $\mathrm{DMU_o}$ is formulated as:

$$\max_{u,v} \quad \theta = \frac{u_1 y_{1o} + u_2 y_{2o} + \cdots + u_s y_{so}}{v_1 x_{1o} + v_2 x_{2o} + \cdots + v_m x_{mo}} \tag{1.1}$$

$$\text{s.t.} \quad \frac{u_1 y_{1j} + u_2 y_{2j} + \cdots + u_s y_{sj}}{v_1 x_{1j} + v_2 x_{2j} + \cdots + v_m x_{mj}} \leq 1, \qquad j = 1, \ldots, n$$

$$u_1, u_2, \ldots, u_s \geq 0$$

$$v_1, v_2, \ldots, v_m \geq 0$$

where θ is the objective function, $u_1, u_2, \ldots, u_s$ are the output weights, $v_1, v_2, \ldots, v_m$ are the input weights, *s* is the number of outputs and *m* is the number of inputs.

Setting the denominator of the objective function equal to one leads to the following linear programming (LP):

$$\max_{\mu,\tau} \quad \theta = \mu_1 y_{1o} + \mu_2 y_{2o} + \cdots + \mu_s y_{so} \tag{1.2}$$

$$\text{s.t.} \quad \tau_1 x_{1o} + \tau_2 x_{2o} + \cdots + \tau_m x_{mo} = 1$$

$$\mu_1 y_{1j} + \cdots + \mu_s y_{sj} \leq \tau_1 x_{1j} + \cdots + \tau_m x_{mj}, \qquad j = 1, \ldots, n$$

$$\mu_1, \mu_2, \ldots, \mu_s \geq 0$$

$$\tau_1, \tau_2, \ldots, \tau_m \geq 0$$

Represented in vector-matrix form, Equation (1.2) can be written as:

$$\max_{v,u} \quad uy_o \tag{1.3}$$

$$\begin{aligned} \text{s.t.} \quad & vx_o = 1 \\ & -vX + uY \leq 0 \\ & v \geq 0 \\ & u \geq 0 \end{aligned}$$

Finally, dual form of the LP in Equation (1.3) corresponds to:

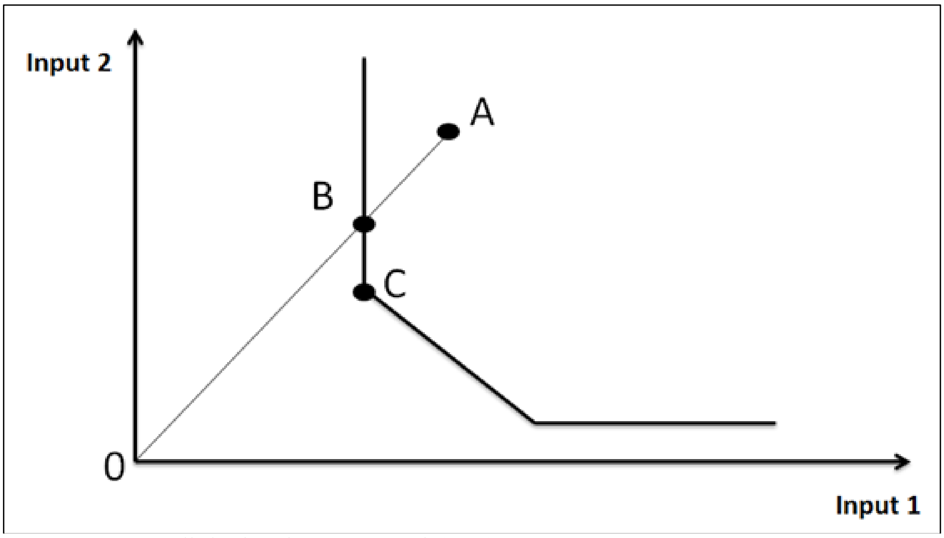
$$\min_{\theta,\lambda} \quad \theta \tag{1.4}$$

$$\begin{aligned} \text{s.t.} \quad & \theta x_o - X\lambda \geq 0 \\ & Y\lambda \geq y_o \\ & \lambda \geq 0 \end{aligned}$$

In the CCR-DEA model formulated, constant returns to scale production set is assumed. The variable returns to scale production set in the DEA was introduced by Banker, Charnes and Cooper in 1984, by including the convexity condition $\sum_{j=1}^{n} \lambda_j = 1$ (written as $\mathbf{e}\boldsymbol{\lambda}$=1 in vector-form, with unity row vector $\mathbf{e}$ and column vector $\boldsymbol{\lambda}$ to be included in Equation (1.4)).

The improvements for the inefficient DMUs occur by a radial projection to the efficient frontier in the CCR and BCC DEA models. A DMU on the efficient frontier (i.e. $\theta = 1$) also needs to satisfy the condition that there are no additional slacks in order to be CCR or BCC efficient. The idea of non-zero slacks is illustrated in Figure 1.1, which represents an input-oriented model aiming to minimize the inputs given the outputs. In this illustration, DMU A is relatively inefficient. The radial projection of this DMU is point B, when the inputs are proportionally improved. However, Input 2 can be further decreased to reach point C, where the Pareto-optimality condition is satisfied.

Figure 1.1: Input-oriented DEA model



Source: own compilation based on Cooper et al. (2007)

In order to overcome this methodological drawback that stems from the possible existence of additional input or output slacks, non-radial additive models have been developed. These models directly address the possible improvements of inputs and outputs and enable non-proportional input reductions or output increases. Following Cooper et al. (2007), a basic additive DEA model can be represented as following:

$$\max_{\lambda, s^-, s^+} \quad z = es^- + es^+ \tag{1.5}$$

$$\begin{aligned} \text{s.t.} \quad & X\lambda + s^- = x_o \\ & Y\lambda - s^+ = y_o \\ & \boldsymbol{e\lambda} = 1 \\ & \boldsymbol{\lambda} \geq 0, s^- \geq 0, s^+ \geq 0 \end{aligned}$$

where s^- is the input slacks and s^+ is the output slacks. Hence, the basic additive model maximizes the sum of input and output slacks for each DMU in order to calculate the efficiency levels. Nevertheless, the value of the objective function *z* is not scale-invariant, i.e. the efficiency scores of DMUs are dependent on the magnitude of input and output values. This hinders a rational comparison of the results. Various specifications of the additive model have been introduced since then to introduce a scale-invariant property. These include the Russell measure- RM

(Färe and Lovell, 1978), the slack-based measure- SBM (Tone, 2001), the range adjusted measure- RAM (Cooper et al., 1999) and the bounded adjusted measure- BAM (Cooper et al., 2011). In this dissertation, the BAM model and the RM model are implemented in Chapter 2 and Chapter 3, respectively.

1.1.2 Spatial Regression

Spatial econometrics deals with regression models, which incorporate the spatial dependence of observations used in the analysis as well as the spatial structure of the model applied. Anselin (1988) describes this field of econometrics as follows:

„The collection of techniques that deal with the peculiarities caused by space in the statistical analysis of regional science models"

Two aspects describe the nature of spatial econometrics. The first aspect focuses on the *spatial dependence*, when observations at the host location are dependent on the observations at other neighboring locations. The distance between two points on space plays an important role regarding the magnitude of the dependence. Tobler's (1970) first law of geography explains this fact as follows:

"Everything is related to everything else, but near things are more related than distant things."

Second aspect is the *spatial heterogeneity*, which arises from varying model parameters or disturbances when moving from one location to another. Thus, the assumption of constant variance over observations is violated. Spatial regression models have been developed to account for these two aspects, namely spatial dependence and spatial heterogeneity, so that the models deliver unbiased estimates.

According to Anselin (1988) and LeSage and Pace (2009), following formulation of spatial regression models, namely spatial lag, spatial error and cross-regressive model can be considered:[4]

[4] Their combinations result in a possibility for seven different specifications of the model.

$$y = \rho \cdot W \cdot y + X \cdot \beta + \Upsilon \cdot W \cdot X + u \tag{1.6}$$

$$u = \lambda \cdot W \cdot u + \varepsilon$$

with $\varepsilon \sim N(0, \sigma_\varepsilon^2 I_n)$

W is an n x n spatial weights matrix which is crucial for incorporating the spatial effects into the regression model.[5] It specifies which spatial unit affects the other ones as well as in which way the interaction takes place (Anselin, 2001; Elhorst, 2013; LeSage and Pace, 2009). In the simplest case, one considers the binary weights with the elements of W-matrix $w_{ij} = 1$, when i and j are neighbors, and $w_{ij} = 0$ otherwise. Another common way to model spatial interaction is to use a smooth or continuous distance decay function so that $w_{ij} = f(d_{ij})$ where d_{ij} is the distance between the unit i and j (Anselin, 2001 and 2002; Anselin et al.,2008; Elhorst, 2013).

When $\rho = \Upsilon = \lambda = 0$ and $\beta \neq 0$, it delivers a standard regression model, which reveals no spatial interaction. When $\rho \neq 0$, $\beta \neq 0$ and $\Upsilon = \lambda = 0$, it is a spatial lag model, which presents the spatial impact of the dependent variable in the host region on the dependent variable in the surrounding regions. The coefficient ρ measures the intensity of the spatial effects. The higher the absolute value of ρ is, the stronger the spatial lag of the dependent variable y influences the calculation of the predicted value of $\hat{y}$. In most cases, the weights matrix is row-standardized for better interpretation so that $W \cdot y$ is the term of the form such that it presents a weighted average of the value of y in the neighboring locations called spatial lag. If $\rho = 0$, $\beta \neq 0$, $\Upsilon = 0$ and $\lambda \neq 0$, it is a spatial error model, which reports the spatial effects in the errors. If $\rho = 0$, $\beta \neq 0$, $\Upsilon \neq 0$ and $\lambda = 0$, it represents a cross regressive model, which presents the spatial impact of the explanatory variables in the host

[5] n presents the number of spatial statistical units considered in the analysis, which refers to the number of airports in this research.

region on the dependent variable in the surrounding regions. Last but not least, one can consider a combination of those models as well, e.g. spatial lag-spatial error model or spatial lag-cross regressive model with the corresponding formal representation.

A spatial lag regression model is used in this dissertation in Chapter 4.

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Chapter 2 - Small regional airport sustainability: Lessons from benchmarking[6]

joint with Nicole Adler[7] and Ekaterina Yazhemsky[8]
published in Journal of Air Transport Management, 33, (2013), 22-31

Abstract

Small and regional airports frequently suffer from limited traffic given minimum fixed infrastructure requirements and insufficient revenues to cover their costs. The question is whether such airports could be structured, managed and possibly financially supported in order to survive efficiently. Efficient operations contribute to decreasing the financial dependency of airports on subsidies or the likelihood of foreclosure. This chapter applies data envelopment analysis in order to estimate the relative efficiencies of a set of 85 European regional airports over the last decade. We estimate the potential savings and revenue opportunities to be in the order of 50% and 25% respectively because cost increases were in excess of any changes in demand over the timeframe. Using second stage regressions we examine the reasons for poor performance, which include discretionary variables such as the failure to search for commercial opportunities or to produce ground-handling and fueling activities in-house. We also note that belonging to an airport system reduces efficiency in the order of 5%. Finally, the break-even passenger throughput over the last decade more than doubled to 464 thousand, however airports behaving efficiently could have covered their annual operating budget with a mere 166 thousand passengers annually.

Keywords: Air Transport; Airports; Benchmarking; Data Envelopment Analysis; Regional Policy

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Chapter 3 - An empirical analysis of group airports: A case of AENA and DHMI

Abstract

Financing small regional airports has been a central topic in Europe. On one hand, some airports are operated individually and receive direct subsidies from the local and federal governments. On the other hand, several public corporations including AENA in Spain and DHMI in Turkey, which operate a vast majority of airports in the country, make use of cross-subsidizations. Due to their airport authority character, there are many similarities of two groups, but they also present many differences with respect to management strategies. Turkish DHMI introduced private involvement in airport operations via Build-Operate-Transfer (BOT) model and concession agreements. In contrast, management and operations of all airports in Spain –with a few exceptions- have remained in AENA. Although these two aviation markets play an important role in Europe due to their high traffic levels, airport groups have attracted little attention in the airport benchmarking literature as far as the international comparison is concerned. This chapter utilizes a data envelopment analysis (DEA) to measure the relative efficiency of airports within AENA and DHMI. Based on the results it further identifies the reasons of inefficiencies resulting from various management strategies and other external factors.

Results indicate higher average efficiency levels at Spanish airports, but private involvement enhances efficiency at Turkish ones. Majority of airports operate under increasing returns to scale. Certain policy options including the application of airport-specific aeronautical charges, decentralization of airport management and improvement of the airport network by closing some inefficient airports should be considered to increase the airport efficiency in both countries.

Keywords: Airport Groups; Public-private Partnership; Airport Efficiency; Data Envelopment Analysis

3.1 Introduction

Although the transfer of airport ownership and management responsibilities to the private sector accelerated in the last decades, a significant amount of public control is still present around the world. One of the main reasons for the ongoing dominance of government involvement in airport operations is the public good characteristic of airport services, whose existence and financing should be based on social and demographical considerations rather than a pure profit orientation. Furthermore organizing the airport network through joint decision-making processes might simplify the technical challenges of operating airports in the country. For these reasons, especially the airports with low international scope attract little interest from private companies. In terms of airport ownership and management, this leads to the important role of state involvement with a few possibilities. Airports in a country can either be operated from a central perspective by a national airport authority, or the airport management is left to local and regional bodies such as the local government or Chamber of Commerce. Finavia (Finland), Hellenic Civil Aviation Authority (Greece), Israel Airport Authority (Israel), Avinor (Norway), ULC (Poland), ANA (Portugal), AENA (Spain), LFV Group (Sweden) and DHMI (Turkey) are the major airport networks in Europe (ACI Europe, 2010).[9] Non-privatized airports in Austria, France, Germany and Italy are subject to individual management.

3.1.1 Motivation

The previous chapter presents the significant negative effect of belonging to an airport group on efficiency and discuss the lack of correct incentives for cost minimization due to the cross subsidies. Moreover, motivation for commercial strategies to create additional revenues at group airports seems to be low in comparison to individual airports (Halpern and Pagliari, 2007). Notwithstanding, efficiency of airports operated as a group has attracted little attention in airport

[9] It should be noted though that there are differences regarding a complete coverage of airports in a country and whether these networks represent a corporatized organization or a civil body as a part of the administration.

benchmarking literature and little focus has been given to the fact that they are a part of an airport authority, group, network or system; but rather their individual performances were evaluated in detail. Spanish airports (Murillo-Melchor, 1999; Martin and Roman, 2001, 2006; Tapiador et al., 2008) have been popular for efficiency studies and some research has been conducted on Greek (Tsekeris, 2011; Psaraki-Kalouptsidi and Kalakou, 2011), Norwegian (Merkert and Mangia, 2012), Portuguese (Barros and Sampaio, 2004; Barros, 2007) as well as Turkish airports (Kiyildi and Karasahin, 2006; Peker and Baki, 2009)[10]. But, mainly due to availability or comparability problems of data, inclusion of such airports in international benchmarking analyses has been very limited and a number of research has called for international analysis of such airports to get a more detailed insight about the level of efficiencies (Lozano and Gutierrez, 2011a; Ar, 2012).

Some similarities between Spain and Turkey regarding the aviation industry are important motivating factors behind this research. First, airports in Spain are managed by AENA (Aeropuertos Españoles y Navegación Aérea) and in Turkey by DHMI (Devlet Hava Meydanları İşletmesi). Both institutions are state enterprises and are responsible for the management of the whole airport network[11] in the country as well as air navigation services. Second, both countries have a similar number of commercial airports. AENA currently operates 46 airports and 2 heliports, DHMI, on the other hand, 52 airports[12]. Nevertheless, airport density in Spain is higher in terms of both per capita and per area, because the former has a population and area of approximately 47 million and 500 thousand square meters respectively and the latter 76 million and 780 thousand square meters. Third, airports within both networks are subject to cross-subsidization, in which profits of financially sound airports cover the costs of loss making airports. Financial data from 2011 show that 19 airports in Spain and only 6 in Turkey were able to cover the operating costs and documented operational profits in terms of "earnings before

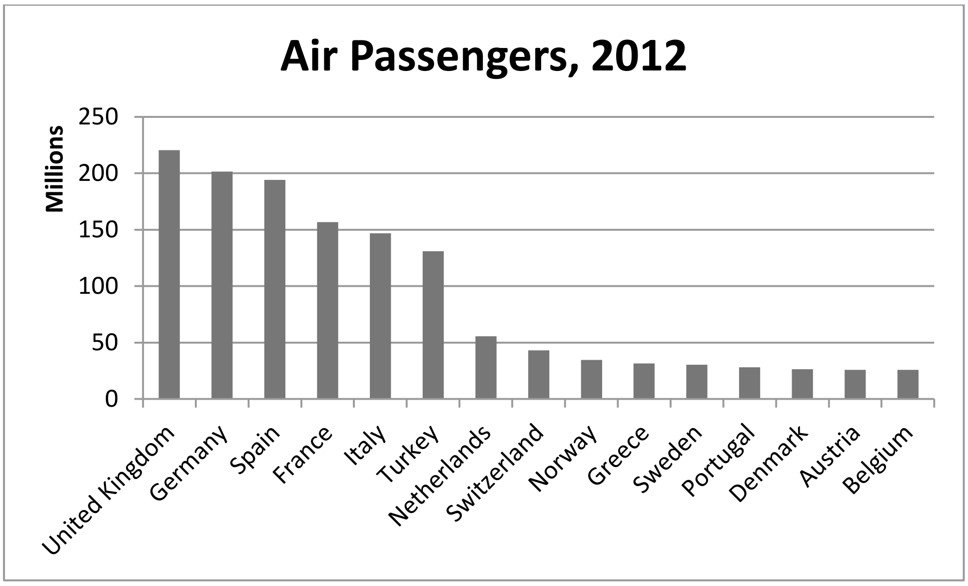
[10] For a detailed overview and main findings of efficiency studies on Spanish and Turkish airports, see "Literature Review" section

[11] There are only a few examples such as Lleida–Alguaire airport in Spain and Istanbul-Sabiha Gökcen airport in Turkey.

[12] By May 2014

interests, taxes, depreciation and amortization" (EBITDA). Fourth, the relative importance of both markets in Europe is worth mentioning. In 2012, Spain was the third largest air transport market in Europe in terms of passengers[13] following the United Kingdom and Germany. On the other hand, since 2001 the demand for air traffic in Turkey showed a 26 percent annual increase in terms of number of passengers, reaching 131 million passengers in 2012, making it the sixth most important market in Europe. Figure 3.1 shows number of air traffic passengers in both countries in comparison to the other markets in Europe and Figure 3.2 presents the yearly development of air traffic in both countries between 2001 and 2012.

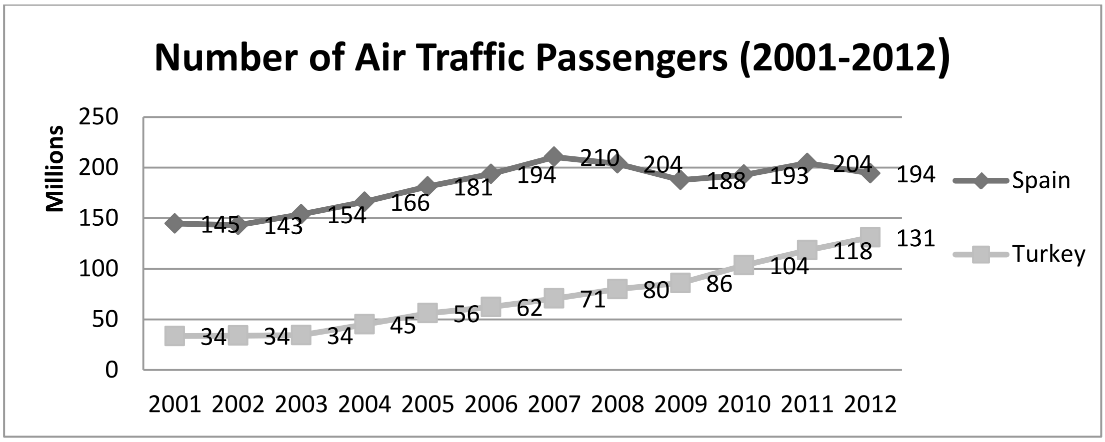
Figure 3.1: Number of air traffic passengers in selected European countries, 2012



(Source: Own compilation by using data from CAA, ADV, AENA, DGAC, Assaeroporti, DHMI, Eurostat)

[13] Spain served approximately 195 million passengers

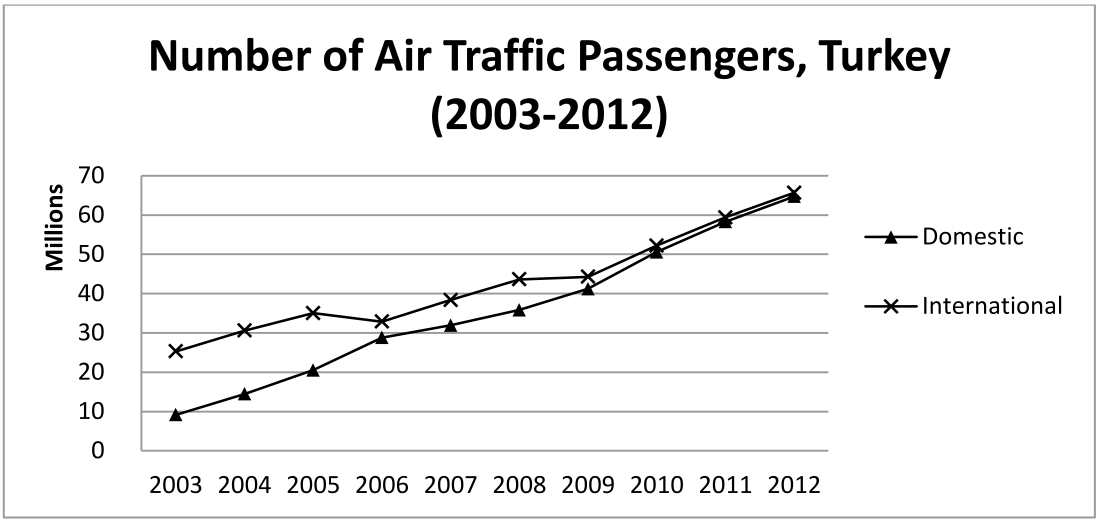
Figure 3.2: Number of air traffic passengers in Spain and Turkey, 2001-2012



(Source: Own compilation by using data from AENA and DHMI)

Although the air transport sector in Turkey was liberalized in 1983, which prepared the ground for market entry and privatization process of various companies in the aviation value chain, the practical implementation has been limited. Subsequently there have been several re-regulations, which especially influenced the domestic market. For a detailed overview of regulations in aviation industry in Turkey, see Gerede (2010). 2003 can be seen as one of the milestones in Turkish air transport history, when all the barriers for entry in the domestic market were removed. In addition, tax advantages to airline companies were introduced and airport charges were reduced. As a result of this deregulation process, a number of private airlines introduced new domestic routes breaking the monopoly of the flag carrier Turkish Airlines, which led to a drastic increase in the number of domestic passengers. Figure 3.3 shows the development of air passenger traffic in domestic and international markets for Turkey after the deregulation in 2003. In addition, the privatization process of Turkish Airlines in 2004 and their focus strategy on transfer flights by using Istanbul-Atatürk airport as hub boosted the demand for international traffic. On top of that, an annual GDP growth amounting to approximately 5 percent in Turkey from 2003 to 2012 should be also mentioned as another explaining factor behind the increasing demand for flights.

Figure 3.3: Number of air traffic passengers in Turkey, 2003-2012



(Source: DHMI)

Last but not least, both countries attract a very high number of tourists, especially in summer months due to their good weather as well as cultural and historical richness. Particularly on the Canary and Baleraic islands in Spain and in the western and southern parts of Turkey, airports play an important role for the international and domestic tourists by providing the necessary infrastructure. Seasonal variations at some of the airports show similarities and are investigated in detail in the next sections.

Although AENA and DHMI are responsible for both airport operations and air navigation services, AENA separated the airport business by founding "AENA Aeropuortos S.A." in June 2011 as a 100 percent subsidiary, whereas such a separation within DHMI does not exist. Another difference between AENA and DHMI can be observed in their international presence regarding airport management. While the former *"participates directly or indirectly in the management of 15 more airports worldwide"* [14], the latter has only focused on the management of airports in the country. Countries where *Aena Desarrollo Internacional S.A.*, which runs AENA's international airport management activities,

[14] http://www.aena-aeropuertos.es/csee/Satellite/conocenos/es/Page/1237548071568// last visited on 27.05.2014

is active include Mexico, Colombia, United Kingdom, United States, Bolivia[15], Sweden, Cuba and Angola[16].

A main difference between the two airport systems has been the way of overcoming the capacity problems at major airports. Even though airport privatization has been in the agenda of the government in Spain, AENA and AENA Aeropuortos have remained in public ownership so far. Hence, the necessary expansions at Spanish airports have been undertaken by public resources. On the other hand, DHMI has chosen public-private partnerships (PPP) via build-operate-transfer (BOT) contracts followed by concession agreements for the constructions and operations of airport terminals at various airports in Turkey.

3.1.2 Privatization Process in Spain

Specifically at Madrid-Barajas (MAD) and Barcelona-El Prat (BCN) airports in Spain, capacity limitations were a major problem at the end of 1990s (Fageda and Fernandez-Villadangos, 2009). A major expansion project "*Barajas Plan"* at MAD was put into effect in 2000 and two new runways and a new terminal were opened in 2006. BCN received a third runway in 2004 and various capacity expansions were made until 2009 including a new terminal. Other busy airports have also been subject to capacity expansions. Some examples include the opening of a new terminal in 2010, a new runway in 2012 at Malaga (AGP) and new terminal area in 2011 at Alicante (ALC) (AENA annual reports, various years).

Due to increasing public debt, the Spanish government decided to privatize the two airports MAD and BCN, as well as to sell stakes of the company in order to raise funds after the economic crisis. The privatization of two airports was supposed to take the form of "20-year-concession agreements" with estimated values of 5.2 billion USD for MAD and 2.3 billion USD for BCN. Nevertheless, these plans were

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[15] In February 2013, the Bolivian government nationalized the three airports leaving AENA out of management.
[16] 2011 Annual Report, AENA

cancelled by the new government in 2012 stating that "*The decline in value could not be recovered*"[17].

3.1.3 Public-Private Partnerships (PPPs) in Turkey

Some of the Turkish airports under the management of DHMI have been subject to private involvement thus far. Like in Spain, capacities of major airports in Turkey did not meet the demand starting in the early '90s, especially regarding the bottlenecks at terminals. Furthermore, quality of service at these terminals was a major concern particularly in terms of the international reputation as these airports attracted many foreign tourists. As a result, terminal expansions became inevitable. To date, terminal capacity expansions have been realized at 6 airports through BOT projects starting with the main touristic airport of the country, Antalya (AYT), in 1994. Figure 3.4 summarizes this methodology used by DHMI in those 6 airports.

Stage 1: Contractual design

The design of the new terminal, total investment amount, revenue sources for the operating company as well as the revenue share agreements between the DHMI and the private companies are documented during the contractual design period. Further, DHMI has offered a guaranteed number of annual passengers in most of the cases.

Stage 2: Selection of an operator and contract execution

Concessionaires bid for the shortest operating period of the terminal with the given parameters from Stage 1. The length of the terminal operations varied from 3 years and 5 months in Terminal 2 at AYT to 15 years and 8 months in Ankara-Esenboga (ESB) airport. After the auction, the concessionaire operates the terminals and DHMI is responsible for the operations of the airside during the execution period. Hence, in addition to being a managerial PPP, the BOT procedure of DHMI can be considered as an operational PPP as well.

Stage 3: Long-term leasing and contract execution

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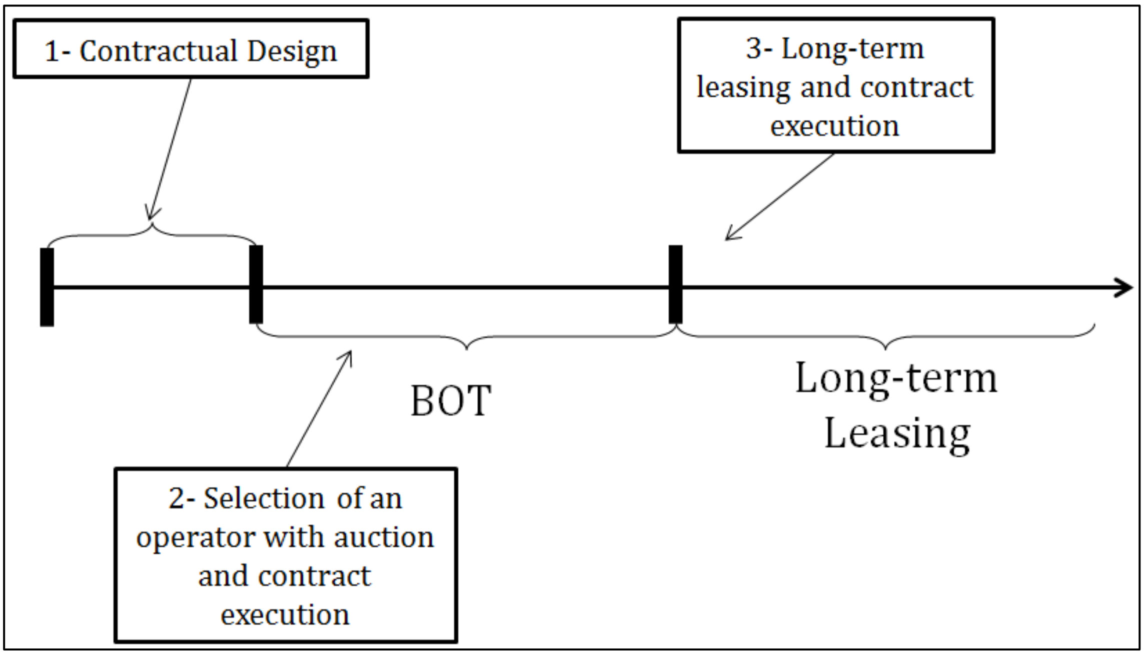
[17] http://www.airportsinternational.com/2012/01/spanish-privatisation-failure , last visited on 27.05.2014

Upon the expiration of BOT period, DHMI applied long-term leasing agreements via auctions at those airports instead of using the "transfer" option, mainly due to efficiency considerations and opportunity of raising funds. At three airports, operational rights of the terminals have already been transferred to private firms for a long-term concession varying from 15 years and 3 months at AYT to 20 years at Izmir-Adnan Menderes (ADB).

Figure 3.4: PPP process in Turkey



Moreover, BOT methodology has also been used for three Greenfield projects. One of these projects – Zafer Airport (KZR) has been completed and airport operations started in 2012 and another one is under construction. The third application is the new airport in Istanbul, which will replace the main airport IST upon completion. It was tendered on May 3, 2013 and acquired by a consortium bidding approximately 22 billion euro for an operation period of 25 years.

Finally, DHMI also applied rental agreements in addition to "BOT approach with a second stage concession" and "Greenfield BOT projects" mentioned above. At three airports, operational rights have been transferred to private firms for a period of 25 years. A detailed overview of the PPPs realized hitherto in Turkey can be found in the Appendix.

3.2 Literature Review

Efficiency levels of Spanish airports have been examined extensively, whereas Turkish airports have not attracted much attention so far. However, international comparison of airports from these two networks with airports from other countries has been very rare and these comparisons have not included the whole network, but rather a limited number of airports. Furthermore, timespan evaluated has not included the years after 2007 in Spain.

Murillo-Melchor (1999) investigates the scale efficiency and technological changes in 33 Spanish airports for the years between 1992 and 1994 by implementing an input-oriented DEA, complemented with a Malmquist index. Her findings show that there are only 2 scale efficient airports in the sample and another 2 airports operate under decreasing returns to scale. Rest of the airports in the sample is subject to increasing returns to scale. Furthermore Malmquist index shows that the total productivity decreases from 1992 to 1994. Martin and Roman (2001) apply an output-oriented DEA to 37 Spanish airports for 1997, which also delivers results about scale economies. 11 airports lie on the efficient frontier and 9 airports operate under decreasing returns to scale. The difference in the number of airports in the increasing returns to scale range from the previous article may imply that the demand increased between 1994 and 1997. Two airports are reported as extremely scale inefficient, namely Cordoba and Salamanca. Martin-Cejas (2002) measures the productivity of 40 Spanish airports for the years 1996 and 1997 by estimating a parametric translog joint cost function. Airports with moderate traffic present higher efficiency levels than those with few or large passenger throughput, implying that the capacity plays an important role in the efficiency. He points out the problematic relationship between the capacity increase and airport charges and criticizes AENA's single charging scheme that hinders efficient pricing. Martin and Roman (2006) use data from 34 Spanish airports for 1997 in order to compare 5 efficiency ranking methodologies. The methodological findings show that the rankings of different models are highly consistent. The authors' policy recommendations include the investigation of the option to close down some airports such as San Sebastian, Santander or Vitoria by concentrating the traffic on the main airport in a province[18]; however they also point out the difficulty of such an action due to political reasons. Barros et al. (2008) utilize various hazard models to find out the determinants of flight delays at 39 Spanish airports for the years between 2005 and 2007. The results show that the delays are caused by higher traffic levels, population in the area of the airport and the hub characteristic of an airport. On the other hand, capacity and the income in the area of the airport contribute to decreasing the delays at the airports. Tapiador et al. (2008) develops a different framework and evaluates the efficiency of 29 Spanish airports in 2006 in terms of geographical characteristics rather than focusing on technical efficiency. The inputs used in a modified DEA are specific to geography, such as population, economic activity and tourism activity. 9 out of 29 airports prove efficient according to the DEA results and for a substantial amount of airports significant improvements in scale are possible. It is concluded that the market lacks competition and individual strategies for each airport due to differences in regional limitations are recommended. Martin et al. (2009) implement a parametric approach to estimate the efficiency and the marginal costs of 37 Spanish airports between 1991 and 1997. Their specification rejects constant returns to scale operations at airports and shows an 83 percent overall efficiency level, with potential improvement in both technical and allocative efficiency. Regarding the airport size, their findings show that on average the larger airports are more efficient than smaller counterparts, possibly because of the pressure to cross-subsidize the smaller, non-profitable airports. Furthermore a clear negative relationship between the marginal costs and airport size is presented. As Martin-Cejas (2002) they also argue the unsuitability of AENA's rigid charging scheme.

Tovar and Martin-Cejas (2009) apply an input oriented stochastic translog distance function to 26 Spanish airports for the years between 1993 and 1999, followed by a

[18] In this case Bilbao

second stage regression in order to examine the effects of outsourcing and commercial activities on airport efficiency. They define outsourcing as contracting any services out to third parties as a complement to labor and capital employed by airport itself and use the share of soft costs in total costs as a proxy for the level of outsourcing at a particular airport. Their main result is that the higher the outsourcing level and share of non-aeronautical revenues at an airport are, the higher the level of efficiency is. Tovar and Martin-Cejas (2010) specify a parametric translog input distance function, which allows for a decomposition of changes in productivity into efficiency and technical changes for the years between 1993 and 1999 for 26 Spanish airports, without having to use input and output prices. Results present an increase in overall productivity, which was driven by a smooth positive technical change. The authors explain this result with the increasing amount of investment throughout this period, which led to modernization at airports. Furthermore, airports in the northern part of the country prove to be more efficient than those in the south. This result leads the authors to postulate that each airport has a distinct potential in terms of privatization and decentralization considerations of AENA. Lozano and Gutierrez (2011a) proposes a target setting methodology in order to measure the efficiency of 41 Spanish airports in 2006 and compare these results with the results of a variable returns to scale, output oriented, non-radial Russell measure of technical efficiency. Their main result indicates that almost all airports produce with increasing returns to scale. Hence, the authors suggest investing in relatively smaller airports with growth potential as well as lowering the number of airports in operation and call for international benchmarking to assess the efficiency better. Lozano and Gutierrez (2011b) include the undesired outputs regarding delays at 39 Spanish airports for 2006 and 2007 by implementing a slack-based DEA, which aims to minimize the ratio of average input reduction to average output increase. A non-oriented, non-radial, variable returns to scale methodology is chosen. With the help of undesired outputs the congestion problem at airports is identified, which may ease the decisions of using other airports. Furthermore, many airports operate technically efficient, however the inefficiency levels of inefficient airports are very large. Martin et al. (2011) investigate the scale economies and marginal costs of 36 Spanish airports for the years between 1991 and 1997 by estimating various short and long run translog cost functions with single or multiple output specifications. Main findings of various estimations include a technological process at airports from 1991 on, very limited possibilities for input substitution, existence of important increasing returns to scale in production as well as minimum efficient scale with 25.6 million work load units (WLU). Similar to previous research, authors conclude that the single price policy of AENA does not allow for cost coverage and question how much capital cost is currently and should be reflected in landing charges. Moreover, they suggest strategies to boost the demand because it would decrease the average costs as scare capacity exists and argue that a single airport in one geographical area could be more cost efficient. Lozano et al. (2013) combine the network DEA methodology with the undesired outputs regarding delays on data from 39 Spanish airports from 2008 and argue that the results of network DEA methodology are sounder than a conventional single stage DEA, because it considers the production as a multi-step process.

On Turkish airports, the literature on efficiency has been limited to DEA so far. To the author's knowledge, no other methodology has been applied to determine the efficiency of Turkish airports. Furthermore, an international comparison of airports in Turkey can be found in two articles (Voltes-Dorta and Pagliari, 2012; Martin et al., 2013), but these papers analyze data only from 8 international airports and ignore a vast majority of the airports operated by DHMI. In addition, detailed investigation of the reasons behind inefficiencies at airports in Turkey is missing in the existing literature. Following review of literature shows the main findings of efficiency studies on the airports in Turkey.

Kiyildi and Karasahin (2006) utilize an input-oriented CCR DEA with a focus on the influence of infrastructure at 32 small airports in Turkey for the years between 1996 and 2002. 7 out of 32 airports prove to operate on the efficient frontier. Ulutas and Ulutas (2009) use data from 31 Turkish airports for the years 2004 and 2005 by implementing a CCR DEA as well. On average, the airports which have been subject to BOT concessions are relatively efficient. They discuss the possibility of privatizing or closing the inefficient regional airports. Peker and Baki (2009) also use an input oriented DEA, additionally they compare the results of CCR and BCC models for 37 Turkish airports in 2007. In a separate analysis, they implement a t-test to investigate the efficiency differences between large and small airports and find out that the large airports are more efficient than the small ones and suggest that airport managers should be in close contact with airlines to increase the demand. Furthermore, they mention the role of government in increasing the demand with particular incentives such as decreasing the tax levels. Finally, they propound the need for an international benchmarking for a more detailed analysis of airport efficiency in Turkey. Kirankabes and Arikan (2011) use data from 2009 for 36 Turkish airports to implement the CCR and BCC DEA. Their findings show that most of the airports are technically efficient but suffer from scale inefficiencies. Their policy conclusion includes not increasing the capacity at a particular airport as long as the current scale is not fully utilized. Kocak (2011) applies both the CCR and BCC types of DEA to a set of 40 Turkish airports from 2008. Similar to previous research, existence of scale inefficiencies is identified. Ar (2012) is the first research on the efficiency of Turkish airports, which investigates the dynamic changes over time by constructing a Malmquist Index following a DEA. 31 Turkish airports for the years between 2007 and 2011 are subject to this analysis and the average total factor productivity change in 5 years amounts to 13 percent, which is mainly driven by the technical efficiency change. He mentions the success of DHMI in managing the airports and underlines the weakness of the analysis due to inexistence of financial data as well as a missing international comparison.

On the light of the institutional settings in both airport systems, which showed many similarities and striking differences in the first section as well as the literature reviewed, Table 3.1 summarizes the background that motivates the current research in comparing the efficiency levels of Spanish and Turkish airports. The analysis in this chapter fills the gap in research by offering an international comparison of efficiency levels for the majority of airports in both countries. Furthermore, a more up to date dataset from Spain is being investigated and the reasons behind the inefficiencies are evaluated. In addition, a detailed review of PPP methodologies in Turkey is presented, which includes all the applications to date.

Table 3.1: Motivating factors of the research

	AENA	DHMI
SIMILARITIES		
State enterprise	✔	✔
Number of airports	46 airports (+2 heliports)	50 airports
ATC provider	✔	✔
Cross-subsidization	✔	✔
Existence of touristic airports	✔	✔
DIFFERENCES		
Number of self-sufficient airports[19]	19	6
Worldwide involvement in airport management	✔	**x**
Airports as a separate business unit	✔	**x**
Private involvement	**x**	✔
LITERATURE TO DATE		
International coverage	**x**	Very limited
Recent data used	**x** (until 2007)	✔ (until 2011)

[19] Based on the data from 2011 and in terms of EBITDA

3.3 Methodology and Data

3.3.1 Input-oriented, Variable Returns to Scale, Russell Measure of Data Envelopment Analysis (DEA)

Additive models aim at maximizing the total input or output slacks, or both, according to the selected orientation (input, output or non-oriented) to calculate the technical efficiency. A basic input-oriented additive model is specified as in Equation (3.1).

$$
\begin{aligned}
& Max\ \ S = \sum_{i=1}^{m} S_i^- \\
& s.t. \quad \sum_{j=1}^{n} x_{ij}\lambda_j + S_i^- = x_{io} \quad \forall \quad i = 1,\dots,m \\
& \qquad\ \ \sum_{j=1}^{n} y_{rj}\lambda_j - S_r^+ \geq y_{ro} \quad \forall \quad r = 1,\dots,s \\
& \qquad\qquad\qquad \lambda_j \ \geq 0 \quad \forall \quad j = 1,\dots,n \\
& \qquad\qquad\qquad S_i^- \geq 0 \quad \forall \quad i = 1,\dots,m \\
& \qquad\qquad\qquad S_r^+ \geq 0 \quad \forall \quad r = 1,\dots,s
\end{aligned}
\tag{3.1}
$$

The major problem with the basic additive models is that scale differences are not taken into consideration as depicted in the objective function *S* in the equation. In the input-oriented additive models, for instance, solely non-weighted sum of input slacks are maximized irrespective of the magnitude of differences in input variables across the decision making units (DMUs)[20]. For this reason, it is not straightforward how to interpret the DEA results when comparing the efficiency levels of various DMUs. In order to overcome this problem, a scale-invariant additive measure, called as Russell measure, was introduced by Färe and Lovell (1978). In input (output) oriented Russell models, the slacks of inputs are weighted by the corresponding number of inputs (outputs) as well as the values of observation in the objective function, hence delivering the maximum of averaged sum of possible improvements.

[20] Each DMU refers to a single airport in a single year in this research.

A Russell measure of Data Envelopment Analysis (DEA) is used in this chapter in order to measure the relative technical efficiency levels of 41 Spanish and 32 Turkish airports. Due to the differences in scale of the airports in the sample, variable returns to scale specification is implemented. Furthermore an input oriented model is chosen, where the airports are required to minimize their inputs by keeping the output levels constant. Last but not least, the variables which cannot be controlled by the managers in the short-run are considered as non-discretionary. Based on Färe and Lovell (1978), Ray (2004) and Cooper et al. (2007), "the input-oriented variable returns to scale Russell measure" utilized in this chapter can be described as follows:

$$
\begin{aligned}
& Max\ \rho = \frac{1}{m}\sum_{i=1}^{m}\theta_i && && (3.2)\\
& s.t. \quad \sum_{j=1}^{n} x_{ij}\lambda_j = \theta_i x_{io} && \forall && i = 1,\ldots,m \\
& \qquad \sum_{j=1}^{n} x_{kj}^{ND}\lambda_j \le x_{ko}^{ND} && \forall && k = 1,\ldots,l \\
& \qquad \sum_{j=1}^{n} y_{rj}\lambda_j \ge y_{ro} && \forall && r = 1,\ldots,s \\
& \qquad \sum_{j=1}^{n} y_{pj}^{ND}\lambda_j \ge y_{po}^{ND} && \forall && p = 1,\ldots,q \\
& \qquad \sum_{j=1}^{n} \lambda_j = 1 \\
& \qquad \lambda_j \ge 0 \\
& \qquad 0 \le \theta_i \le 1
\end{aligned}
$$

In Equation (3.2), x represents the inputs, y stands for the outputs, m is the number of discretionary inputs, l is the number of non-discretionary inputs, s is the number of discretionary outputs, q is the number of non-discretionary outputs, θ is the weighted input slacks and λ_j is the intensity variable. The results were obtained by the EMS Software.

3.3.2 Scale Efficiency

Previous literature on airport benchmarking has given a great attention on the scale of airport operations and generally assumed that the airports operate under variable returns to scale (VRS) rather than under constant returns to scale (CRS), due to the fact that the airports are not flexible in the short-run considering the choice of input levels. Thus, very small or very large airports are treated in an unbiased way when calculating the DEA efficiency scores. Two questions emerge with respect to the scale.

First one deals with the level of inefficiency, which results from not operating on the optimal size. Unless the efficiency scores from CRS-DEA and VRS-DEA are equal to each other, inefficiencies due to scale will exist and the level of scale efficiency for input-oriented models can be calculated by the ratio of distances attained from CRS-DEA and VRS-DEA, respectively. Due to the fact that the distances are the technical efficiency scores from CRS-DEA and VRS-DEA models, scale efficiency can be easily attained by the ratio of technical efficiency scores of two specifications. (Coelli, 2005; Färe et al., 1998)

$$SE = \frac{TE_{crs}}{TE_{vrs}} \qquad (3.3)$$

Second question, on the other hand, investigates whether the airports operate under decreasing, constant or increasing returns to scale (DRS, CRS and IRS, respectively). Literature on production of airport services shows that a vast majority of airports operate under IRS, mainly due to the large, indivisible fixed investments, which cannot be matched with an adequate traffic demand. For instance, Martin and Voltes-Dorta (2011) argues that even for large hubs, there is a potential advantage of expanding the size of operations. A Cobb-Douglas type long-run cost function applied to 41 airports from Australia, Asia, North America and Europe delivers these conclusions. Furthermore, Assaf (2010) estimates a Cobb-Douglas specification of cost function and the analysis delivers results that support increasing returns to scale production.

3.3.3 Data

Initially, financial data from AENA and DHMI were collected for the years between 2009 and 2011. Detailed analyses of the financial data together with traffic figures and additional information have led to restricting the dataset. For example, 2 heliports Algeciras and Ceuta as well as the airports Madrid-Cuatro Vientos, Huesca-Pirineos, Sabadell and Son-Bonet in Spain have been removed from the sample due to their very low and volatile traffic and inconsistent financial situation. Regarding the Turkish airports some airports have not been included in the sample, because Agri, Balikesir, Siirt, Tokat and Balikesir-Körfez airports lack traffic in some years; Batman, Gökceada and Kocaeli airports were opened within the sample period and some variables needed for the second stage regression were not available for Canakkale and Sinop airports.

Furthermore the two main hub airports in both countries, Madrid-Barajas and Istanbul-Atatürk have been excluded from the sample because of two reasons. First reason is their relative larger size in comparison to other airports and the second is their hub status with very high concentration of flag carriers Iberia and Turkish Airlines. It seems more reasonable to compare the efficiency levels of these airports with other international hub airports, because their characteristics are more similar and they compete for a high amount of transfer traffic.

Consequently, the analyses in this chapter are based on 41 Spanish and 32 Turkish airports covering a three-year period from 2009 to 2011. For the Spanish airports, balanced data is available for the entire time period, whereas data for some years are missing for eight airports in Turkey. The reason behind the exclusion of these Turkish airports for some years is the closure of the airports for several months within the time period of study due to runway extensions and maintenance. By excluding those from the dataset, any distortion due to sudden changes in traffic levels can be avoided.

Staff costs (StaffC), other operating costs (OtherC) and total runway area (RWY) are selected as the inputs. Depreciation is not included in the other operating costs, because the capital base of the airports is measured by using the physical indicator RWY, due to possible differences in the accounting methods between the two countries[21]. Furthermore, taxes or financial expenditures are removed from the costs. Runway area is calculated as the length of a runway multiplied by the width over all available runways at an airport. In the sample, Barcelona and Antalya airports have 3 runways, 7 airports from Spain and 8 airports from Turkey have 2 runways and the rest of the airports operate with a single runway.

Outputs include the three traffic statistics number of passengers (PAX), air traffic movements (ATM) and the level of cargo (Cargo) as well as the total operating revenues (TotRev). Total operating revenues are calculated as the sum of aeronautical and non-aeronautical revenues. The high correlation between the aeronautical revenues and the three traffic outputs PAX, ATM and Cargo can be considered to be problematic and in the optimal case use of non-aeronautical revenues alone might be preferable. However a detailed disaggregation of data on revenues is not obtainable from both countries, which would allow for ensuring whole comparability of two revenue types with their corresponding sub-accounts. In order to avoid this possible distortion due to incomparability, "total operating revenues" is preferred to "non-aeronautical revenues" as one of the outputs used in the DEA.

AENA reportedly clarified that the costs from the head-quarter are effectively allocated to the available data for each airport under the management of AENA according to a sophisticated methodology, which accounts for various cost centers within the organizational structure as well as the use of resources. On the other hand, DHMI reports the head-office costs separately without distributing them to the airports. For this reason, these costs are distributed by weighting according to the total costs of the individual airports, which delivers a more comparable cost data among airports from the two countries. Financial, traffic and technical data as well

[21] A specification of the model, where "depreciation" is used as an input instead of "RWY", has been applied to check the robustness of the model and it delivers very similar results. The detailed results are not presented in this dissertation, but they are available upon request.

as the entire data on second stage variables except population density have been gathered directly from AENA and DHMI. Population density (NUTS) data used in the second stage regression have been collected from the Eurostat webpage. All the financial variables are converted to euro by using the purchasing power parity and inflation indicators obtained from the OECD database, in order to account for the differences across two countries and across various years, respectively.

It should be noted that the efficiency scores calculated are intended to be evaluated from the point of view of the two airport authorities AENA and DHMI. As there is no private involvement at Spanish airports it is not necessary to have any concerns about the results on AENA's airports. On the other hand, the situation regarding 5 Turkish airports[22] in the sample is rather different, because these airports are jointly operated by DHMI and private firms. Private firms pay fees to DHMI for the operational rights and there are different agreements at each airport concerning how the revenues are shared between the two parties. Furthermore, the accounts of the private firms in Turkey, which jointly operate the airports, are not publicly available. Hence, the revenues of DHMI from these airports include the fees paid by the private firms for the operating rights of terminals either as a part of either BOT or concession agreement. Besides, the costs accrued to DHMI at these airports are lower than airports with similar size, mainly because DHMI employs much less employees at these airports. As a result, the outcomes of the analysis can be seen as the ability of the airport authority to generate profits while maintaining the airport services, either operating them by itself or delivering these rights or responsibilities to the private firms.

3.4 Results

Results of the Data Envelopment Analysis (DEA) from model specification in Equation (3.2) are presented in Figure 3.5 for the average values between 2009 and 2011. A value equal to 1 represents an airport with zero slacks, i.e. the corresponding DMU lies on the efficient frontier. Only Málaga, Badajoz, Salamanca

[22] These 5 airports are Ankara-Esenboga, Antalya, Izmir-Adnan Menderes, Mugla-Milas Bodrum and Mugla-Dalaman.

and Hierro airports are fully efficient in all three years of analysis. The average score for the Spanish airports is 0.84, whereas the average score for the Turkish airports is 0.71. This indicates a higher average efficiency level for Spanish airports and is statistically tested in the second stage regression below as well. Individual efficiency scores for each airport and each year can be found in the Appendix.

Figure 3.5: Average efficiency scores for Spanish and Turkish airports

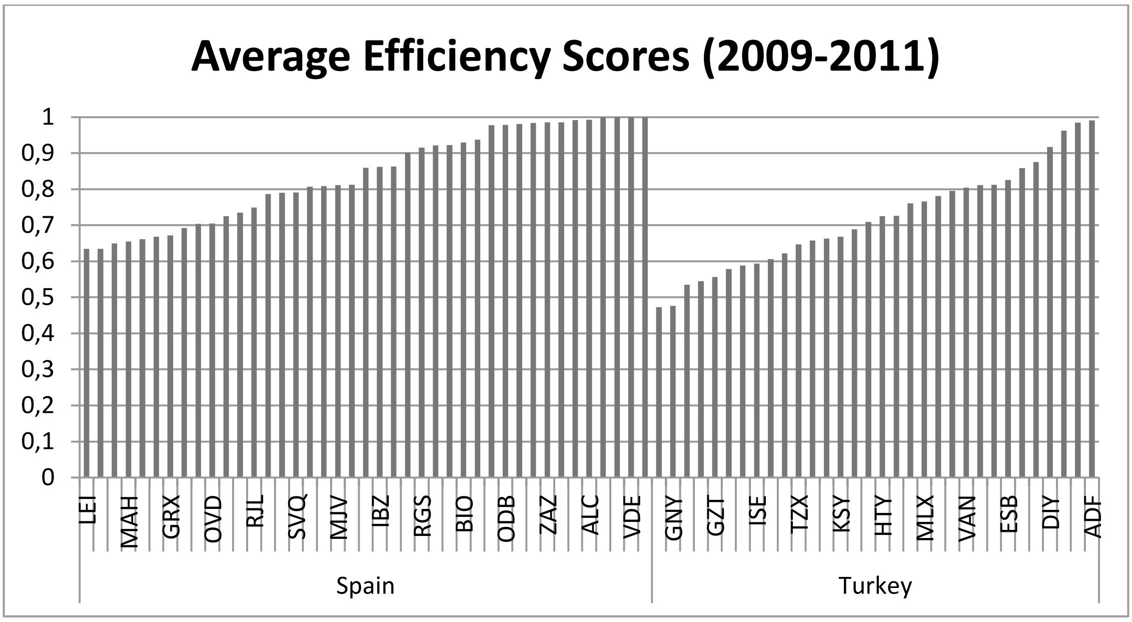


Figure 3.6 presents the levels of scale efficiency in 2011 and Table 3.2 additionally shows whether the airports operate under increasing or decreasing returns to scale for the year 2011. Although most of the airports represent high level of scale efficiency, there are a significant number of smaller airports that suffer from scale inefficiencies. A vast majority of airports operate under increasing returns to scale in 2011. Only 4 airports in Spain and 3 airports in Turkey operate under decreasing returns to scale, which are relatively large airports by their traffic volumes with only one exception.

Figure 3.6: Scale efficiency at Spanish and Turkish airports, 2011

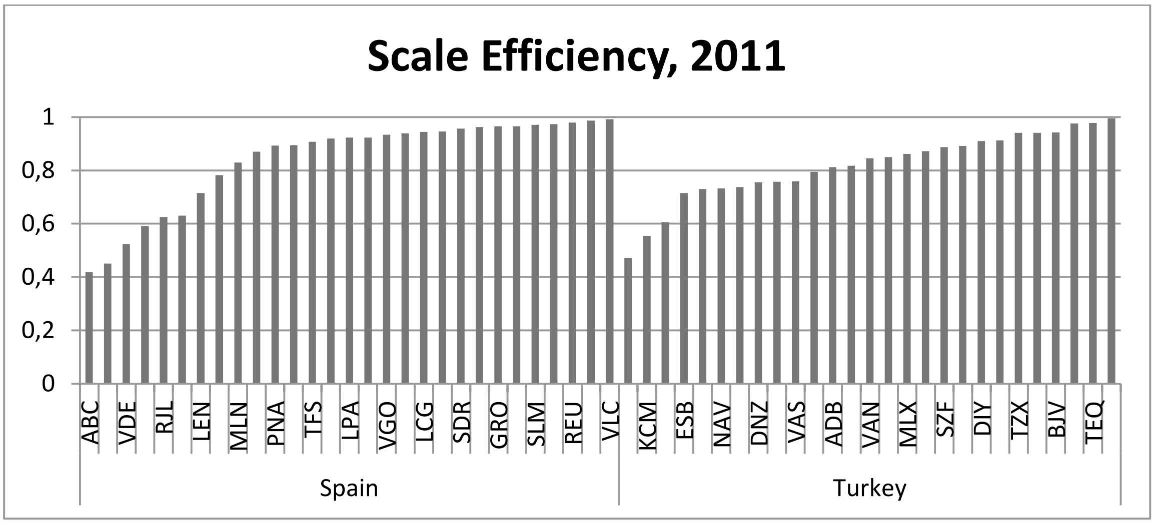


Table 3.2: Scale efficiency and returns to scale at Spanish and Turkish airports, 2011

Spain						**Turkey**					
IATA	Scale Efficiency	RTS	IATA	Scale Efficiency	RTS	IATA	Scale Efficiency	RTS	IATA	Scale Efficiency	RTS
ABC	0.419	irs	ODB	0.782	irs	ADA	0.995	irs	MLX	0.861	irs
ACE	0.946	irs	OVD	0.919	irs	ADB	0.811	drs	MSR	0.605	irs
BIO	0.986	drs	PNA	0.893	irs	ASR	0.872	irs	NAV	0.732	irs
BJZ	0.591	irs	REU	0.979	irs	BJV	0.942	irs	SZF	0.887	irs
EAS	0.870	irs	RGS	0.631	irs	DIY	0.910	irs	TEQ	0.978	drs
FUE	0.998	irs	RJL	0.624	irs	DLM	0.976	irs	TZX	0.941	irs
GMZ	0.451	irs	SCQ	0.965	irs	DNZ	0.755	irs	USQ	0.471	irs
GRO	0.965	irs	SDR	0.956	irs	ERC	0.729	irs	VAN	0.845	irs
GRX	0.939	irs	SLM	0.971	irs	ERZ	0.891	irs	VAS	0.759	irs
IBZ	0.998	drs	SPC	0.963	irs	ESB	0.716	drs	YEI	0.912	irs
LCG	0.944	irs	SVQ	0.997	drs	EZS	0.758	irs			
LEI	0.973	irs	TFN	0.997	irs	GNY	0.817	irs			
LEN	0.715	irs	TFS	0.908	irs	GZT	0.941	irs			
LPA	0.923	drs	VDE	0.524	irs	HTY	0.795	irs			
MAH	0.998	irs	VGO	0.934	irs	KCM	0.555	irs			
MJV	0.923	irs	VLC	0.991	irs	KSY	0.737	irs			
MLN	0.830	irs	VLL	0.894	irs	KYA	0.849	irs			
			Average Spain: 0.865						**Average Turkey: 0.816**		

In order to explain the efficiency scores, a second stage OLS regression is conducted on eleven explanatory variables, two of which are yearly dummy variables. Because a higher score indicates a higher efficiency level for the airport, a positive sign of the independent variable from the second stage regression shows a positive effect of the corresponding variable on the level of efficiency. The first four variables can be directly or indirectly controlled by the airport operators AENA and DHMI.

Airports with high traffic both in Spain and Turkey, such as Gran Canaria, Malaga, Palma de Mallorca, Ankara, Antalya and Izmir, are open to operations 24 hours with or without restrictions on aircraft type. On the other hand, for smaller airports with low traffic, opening hours can be used as a strategy to adjust the costs to varying traffic. For instance, in the data sample used in this analysis, there are airports, which are open to service only for 4 hours daily. In order to control for the influence of this strategy on the level efficiency, total weekly operating hours of airports have been included in the second stage regression. The negative sign of the coefficient shows that airports with longer operational hours are statistically less efficient. A hundred percent increase in weekly opening hours would lead to 13 percent less efficiency levels.

Different strategies regarding the private involvement on airport management have been explained in the first section. While AENA operates all the airports by itself, DHMI has handed in the operation responsibilities of a number of airports to the private sector via BOT or leasing agreements. Impact of this involvement has been investigated by including a dummy variable in the regression, which takes the value of 1 for those Turkish airports that include private sector involvement. According to the regression results, DHMI's collaboration with the private firms on airport operations contributes to increasing the efficiency level. Those airports depict 16 percent higher efficiency levels than their counterparts with no private involvement.

Literature on airport benchmarking very often used the share of commercial revenues and the share of international traffic to explain the efficiency scores. However, in this research both variables prove to be statistically insignificant. Insignificance of the former can be explained with the high number of small airports in both systems, which have very limited potential for commercial activities and corresponding revenues. Such airports extensively rely on aeronautical fees.

Insignificant results for the second one, on the other hand, seem to be due to the importance of domestic traffic both in Spain and Turkey.

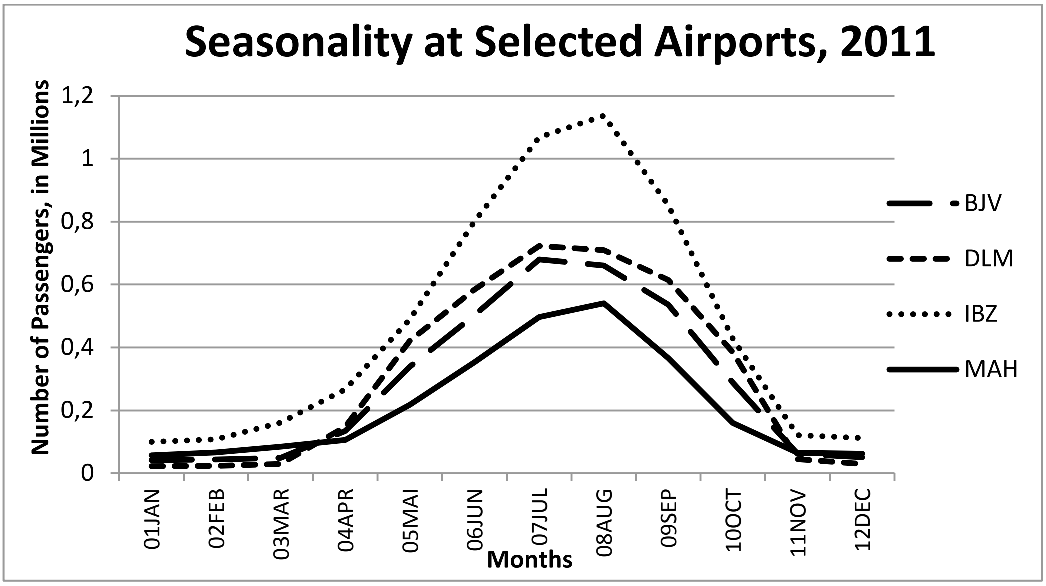
Airport size, measured by work load unit (WLU), has a negligible but significant effect on the airport efficiency. Doubling the WLU served at the airport would lead to a 3 percent increase in the efficiency level. However, this result is especially of importance for very small airports, because with the help of various strategies a duplication of demand is feasible in comparison to larger airports. Furthermore, population density around the airports has been included in the regression in order to account for the catchment area and measured by using NUTS III level statistics from the Eurostat. Each country is divided into administrative units by Eurostat and this statistic is calculated by dividing the population of this unit to the corresponding surface area. The main drawback of this statistic is that there is no standardization for the surface area measure. For instance, the NUTS III administrative area at one location can be composed of a single city, whereas a very large geographical area can determine the administrative area in another location. Unfortunately, a better proxy or statistic is not available to account for the catchment area of the airports. The quality of data, together with the fact that inbound traffic plays an important role in both countries due to tourism, can explain the insignificance of the "population density" variable.

Similar to the traffic variations within a day, which can be dealt with opening hour strategies, variations of traffic within a year is another challenge for the airports. Figure 3.7 shows the monthly passenger traffic at the 4 airports with the highest yearly variations in traffic in Spain and Turkey for 2011. These airports serve the summer touristic locations and reach up to 1.1 million passengers in a particular month in summer, while their traffic volume is very low (22 thousand in DLM in January, for example) in winter months. The analysis of monthly traffic also helped to determine the airports, which were excluded from the efficiency analysis due to insufficient or very volatile traffic in specific periods in order not to distort the analysis. In order to include the yearly variation of traffic in the second stage regression, the GINI coefficient has been calculated for each airport and each year by using the monthly passenger traffic statistics. The GINI coefficient is a common statistic to measure such variations in the literature and has numerous specifications. Following Dixon et al. (1988), an unbiased estimator of GINI coefficient has been calculated as follows:

$$G = \frac{\sum_{i=1}^{n} (2\mathrm{i}-n-1)x_i'}{n\mu(n-1)} \qquad (3.4)$$

where, n is the number of months (hence equals 12), x_i is the passenger traffic for each month, μ represents the mean value of the passenger traffic in one year. A higher GINI coefficient indicates a higher level of seasonality. Nevertheless, the regression analysis delivers statistically insignificant results for this variable, indicating that there is statistically no difference regarding the efficiency levels of seasonal and non-seasonal airports. This insignificant result proves that the managers of seasonal Spanish and Turkish airports have been successful in developing strategies to match their inputs to the varying outputs throughout the year.

Figure 3.7: Seasonality at selected airports in Spain and Turkey, 2011



Further, 12 airports in Spain and 13 airports in Turkey are open to joint military operations. In some of the cases such airports were built as air bases and later opened to civil aviation. A dummy variable accounts for these airports in the second stage regression. The results show that such airports are almost 10 percent more efficient than their counterparts that are only open to civil aviation. Sharing the costs of operations with the military possibly leads to the relative higher efficiency levels for such airports. Finally, a dummy variable with a value of 1 has been used for the airports in Spain in order to test for efficiency differences between two countries. On average, Spanish airports obtain a score that is approximately 18 percent higher than the Turkish airports indicating higher average efficiency levels. Last but not least, airports achieve higher efficiencies both in 2010 and 2011 than in 2009 due to the dummy variables included in the regression. Although this result can be interpreted as the recovery from the financial crisis of 2008 and 2009, results are not statistically significant. Table 3.3 presents the coefficients and the t-statistics of the second stage OLS regressions.

Table 3.3: Results of the second stage OLS regression

dependent variable: efficiency score		
explanatory variables	**coefficient**	**t-statistic**
weekly opening hours	-0.132	-2.66
bot (ppp) partnership (dummy)	0.166	2.69
share of commercial revenues	0.047	1.18
percentage of international traffic	-0.023	-1.62
work load unit (airport size)	0.034	2.70
population density	0.018	1.13
seasonality measured by gini	0.026	1.06
joint military-civil airport (dummy)	0.098	3.38
spain (dummy)	0.178	4.79
2010 (dummy)	0.019	0.63
2011 (dummy)	0.006	0.21

3.5 Conclusion

Airport networks in Spain and Turkey present similarities from different perspectives. Both airport networks are operated by a state enterprise (AENA and DHMI, respectively) and operate a similar number of airports in total. Both enterprises provide ATC services as well. In both networks cross-subsidization is an important property of the system, where the losses of smaller and unprofitable airports are covered by the profits of financially self-sustainable airports. On the other hand, AENA and DHMI have some differences. Whereas AENA has a worldwide involvement in airport management, DHMI only focuses on the operations of airports in Turkey. Furthermore, AENA airports operate as a separate business unit. Finally, a number of Turkish airports are subject to private involvement via BOT and leasing agreements, but the privatization plans have been postponed in Spain thus far.

These similarities and differences, together with the importance of both countries in air transport in Europe in terms of high number of traffic as well as recent growth, led to the analysis of comparative efficiency for Spanish and Turkish airports. In this chapter, an additive input-oriented, variable returns to scale Russell specification of Data Envelopment Analysis (DEA) with non-discretionary variables has been implemented by using data from 41 Spanish and 32 Turkish airports for the years between 2009 and 2011. Results indicate a higher average efficiency level for Spanish airports. Only 4 airports lie on the efficient frontier for the whole period and these airports are all located in Spain.

Different specifications have been used for the efficiency analysis in terms of input and output variables as well as the airports included in the dataset in order to check for robustness. First, depreciation has been used as an input instead of the runway area to account for the capital input. Second, airports in Turkey that are operated by private firms via BOT or leasing agreements have been excluded from the dataset, because they present different financial structures than the other airports in the sample. Finally, hub airports in both countries, Madrid-Barajas and Istanbul-Atatürk, have been included in the sample. All these specifications delivered similar results and did not affect the main conclusions of this research.

Although technical inefficiency constitutes the most important part of inefficiencies, not operating in optimal scale for a number of airports should not be ignored. Most of the airports operate under increasing returns to scale. Hence, airport managers should seek ways for increasing the demand by implementing various strategies. Applying different aeronautical fees at each Spanish airport is one possibility to overcome this problem (Martin-Cejas, 2002; Martin et al., 2009). In addition, decentralization of airport management by delivering the airport operations to local governments or other local institutions including private firms in both countries seems to be another option to cope with such difficulties. Additionally, improving the airport network in both countries by closing a number of inefficient regional airports and concentrating the traffic on larger airports is another policy recommendation, which could increase the efficiency of the whole system in the long-run. These recommendations are consistent with those of Ulutas and Ulutas (2009) and Lozano and Gutierrez (2011a).

The results of the second stage regression support the above mentioned recommendations. Implementing reduced opening hours for airports adjusted to the variation in daily traffic, especially for small regional airports, will result in lower operational costs and increase the efficiency. Although the Turkish airports are relatively less efficient than the Spanish counterparts, public-private partnership strategy applied at 5 airports in the sample, has contributed to the efficiency from DHMI's point of view. Hence, DHMI should continue seeking such opportunities as long as there is private interest at a particular airport. It does not only increase the efficiency at the airport, but also provides the necessary financing for a more modern, new and high-quality airport infrastructure. The recent decision of DHMI about the second stage leasing tender upon ending the BOT period at Mugla-Dalaman and Mugla-Milas Bodrum airports as well as the leasing tender for Samsun-Carsamba and Nevsehir-Kapadokya airports in the near future shows that the DHMI is going to continue with this successful strategy.

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Appendix

Table A3.1: Yearly efficiency scores for Spanish airports, 2009-2011

Airport	IATA	2009	2010	2011	Airport	IATA	2009	2010	2011
A Coruña	LCG	0.70	0.69	0.69	Logroño	RJL	0.78	0.71	0.75
Albacete	ABC	0.90	0.91	1.00	Málaga	AGP	1.00	1.00	1.00
Alicante	ALC	0.98	1.00	1.00	Melilla	MLN	0.68	0.70	0.73
Almería	LEI	0.61	0.64	0.65	Menorca	MAH	0.62	0.68	0.66
Asturias	OVD	0.70	0.73	0.68	Murcia - San Javier	MJV	0.90	0.79	0.74
Badajoz	BJZ	1.00	1.00	1.00	Palma de Mallorca	PMI	0.98	1.00	1.00
Barcelona	BCN	0.95	1.00	1.00	Pamplona	PNA	0.67	0.66	0.65
Bilbao	BIO	0.92	0.93	0.94	Reus	REU	0.81	0.86	0.75
Burgos	RGS	0.89	0.85	1.00	Salamanca	SLM	1.00	1.00	1.00
Córdoba	ODB	1.00	0.94	1.00	San Sebastián	EAS	0.72	0.74	0.75
Fuerteventura	FUE	0.73	0.80	0.82	Santander	SDR	0.83	0.77	0.84
Girona	GRO	1.00	1.00	0.76	Santiago	SCQ	0.62	0.65	0.64
Gran Canaria	LPA	0.95	1.00	0.99	Sevilla	SVQ	0.77	0.79	0.82
Granada	GRX	0.69	0.67	0.66	Tenerife-Norte	TFN	1.00	1.00	0.96
Hierro	VDE	1.00	1.00	1.00	Tenerife-Sur	TFS	0.73	0.80	0.90
Ibiza	IBZ	0.81	0.91	0.87	Valencia	VLC	1.00	1.00	0.93
Jerez de la Frontera	XRY	0.93	0.84	1.00	Valladolid	VLL	0.74	0.76	0.67
La Gomera	GMZ	0.85	0.85	1.00	Vigo	VGO	0.69	0.66	0.59
La Palma	SPC	0.67	0.66	0.67	Vitoria	VIT	0.79	0.80	1.00
Lanzarote	ACE	0.82	0.87	0.89	Zaragoza	ZAZ	0.96	1.00	1.00
León	LEN	0.78	0.77	0.82	**Average**		**0.83**	**0.84**	**0.85**

Table A3.2: Yearly efficiency scores for Turkish airports, 2009-2011

Airport	**IATA**	**2009**	**2010**	**2011**	**Airport**	**IATA**	**2009**	**2010**	**2011**
Adana	ADA	0.70	0.79	0.79	Kars	KSY	0.68	0.68	0.65
Adiyaman	ADF	1.00	0.98	NA	Kayseri	ASR	0.66	0.66	0.67
Amasya-Merzifon	MZH	0.92	0.83	NA	Konya	KYA	0.64	0.68	0.64
Ankara-Esenboga	ESB	0.66	0.82	1.00	Malatya	MLX	0.86	0.78	0.67
Antalya	AYT	0.95	1.00	1.00	Mardin	MQM	0.86	0.76	NA
Bursa-Yenisehir	YEI	0.48	0.47	0.47	Mugla-Dalaman	DLM	0.70	0.74	0.73
Denizli-Cardak	DNZ	0.57	NA	0.52	Mugla-Milas Bod.	BJV	0.68	0.71	0.73
Diyarbakir	DIY	0.82	1.00	0.93	Mus	MSR	0.82	0.80	0.77
Elazig	EZS	0.66	0.71	0.70	Nevsehir-Kapad.	NAV	0.53	0.54	0.53
Erzincan	ERC	0.65	NA	0.56	Samsun-Carsamba	SZF	0.58	0.58	0.61
Erzurum	ERZ	0.57	0.61	0.55	Sanliurfa-GAP	GNY	0.47	0.48	0.47
Gaziantep	GZT	0.54	0.56	0.57	Sivas-Nuri D.	VAS	0.73	0.60	0.54
Hatay	HTY	0.74	0.77	0.67	Tekirdag-Corlu	TEQ	0.89	1.00	1.00
Isparta-Süleyman D.	ISE	NA	0.59	NA	Trabzon	TZX	0.62	0.65	0.66
Izmir-Adnan M.	ADB	0.65	0.92	1.00	Usak	USQ	NA	NA	0.78
Kahramanmaras	KCM	0.89	NA	0.74	Van-Ferit Melen	VAN	0.79	0.82	0.80
					Average		**0.71**	**0.73**	**0.71**

Table A3.3a: PPPs via build-operate-transfer (BOT) arrangements in Turkey

Airport	Scope	Year of Tender	Winner	Operation Start	Operation Period	Investment Period	Investment Amount
Antalya	Terminal 1	1994	Fraport (+Bayindir)	1998	9 y	2 y	65,5 million USD
Istanbul-Atatürk	International Terminal	1997	TAV	2000	3 y, 8 m	30 m	306 million USD
Mugla-Dalaman	International Terminal	2003	ATM	2006	6 y, 5 m, 20 d	2 y	72,4 million USD
Antalya	Terminal 2	2003	Celebi- IC Ictas	NA	3 y, 5 m, 26 d	NA	71,1 million USD
Ankara-Esenboga	Domestic and International Terminal, Car Park	2004	TAV	2006	15 y, 8 m	Plan:36 m Actual:24m	188 million USD
Izmir-Adnan Menderes	International Terminal	2004	Havas-Bayindir	2006	7 y, 4 m, 26 d	2 y	125 million USD
Mugla-Milas Bodrum	International Terminal	2006	Teknotes-Aerodrom Beograde [23]	2012	3 y, 9 m	14 months	> 100 million USD

Table A3.3b: PPPs via Greenfield arrangements in Turkey

Airport	Year of Tender	Winner	Operation Start	Operation Period	Investment Period	Investment Amount
Zafer	2010	IC Ictas	2012	29 y, 11 m	Plan: 36 m Actual: 18 m	50 million EURO
Cukurova	2011	S.L / Z.C.A.[24]	Not started yet	9 y, 10 m, 10 d	Plan: 36 m	357 million EURO
Istanbul New	2013	Limak-Kolin-Cengiz-Mapa-Kalyon	Not started yet	25 y	Plan: 42 m	app. 10 billion EURO

[23] Winning consortium did not start with construction due to financial problems. Astaldi took over the construction and also the operational rights upon completion.

[24] Consortium of Sky Line Transport Trade Corporation and Zonguldak Civil Aviation Industry and Trade Corporation

Table A3.3c: PPPs via leasing arrangements in Turkey

Airport	**Scope**	**Year of Tender**	**Winner**	**Operation Start**	**Operation Period**	**Investment Period**	**Investment Amount**
Istanbul-Atatürk	International, Domestic, GA Terminals; Car-parking	2005	TAV	2005	15 y, 6 m	No investment	No investment
Antalya	T1+T2+Domestic+CIP	2007	Fraport - IC Ictas	2007 (T1+D) 2009 (T2)	17 y, 3 m, 17 d and 15 y, 3 m, 8 d	No investment	No investment
Izmir-Adnan Menderes	Building and Operating Domestic Terminal + Operating International Terminal + CIP Terminal	2011	TAV	2012	NA	NA	Domestic Terminal: 250 million EUR
Zonguldak	Airside + Terminal Operations	2006	Z.C.A.	2007	25 y		
Antalya-Gazipasa	Airside + Terminal Operations	2007	TAV	2009	25 y		
Aydin-Cildir	Airside + Terminal Operations	2012	Turkish Airlines	2012	25 y	No investment	No investment

Chapter 4 - How scale and institutional setting explain the costs of small airports: An application of spatial regression analysis

joint with Vahidin Jeleskovic[25] *and Jürgen Müller*[26]

Abstract

One of the main pillars of efficient airport operations is cost-minimization. Unit costs of operation with respect to the level of passengers served are a possible proxy to measure the cost efficiency of an airport. Airport cost functions should be able to explain the total costs with the main inputs labor, material and capital as well as by taking the airport specific characteristics into account. In this study, we focus on airport specific characteristics. We use a spatial regression methodology to explain how these drive the unit costs and analyze the spatial relationship among the dependent variables. Two separate data samples from Norwegian and French airports are used in this research to test various hypotheses.

Because a large number of regional airports in both countries cannot reach financial break-even, our first research question deals with the effects of subsidies, which often follow regional and political considerations. One must therefore find an efficient way to maintain these airports without any distortions on the incentives. When evaluating the relationship between subsidies and unit costs, we find negative effect of subsidies on airport cost efficiency. Second, we evaluate the importance of economies of scale by focusing on the relationship between airport size and unit costs. Finally, the results of spatial regression show that a denser spatial distribution of airports results in higher unit costs as a consequence of lower capacity utilization, indicating the negative effect of spatial competition on airport unit costs within an airport network.

***Keywords**:* Airport Costs; Airport Subsidies; Spatial Regression; Scale Economies

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4.1 Introduction

The need for high output levels for airports in order to be able to achieve cost-efficient operations has always been a challenging issue for airport managers and authorities, as well as the political decision makers. Airports serving a higher number of passengers are able to exploit the cost advantages of distributing the fixed costs over a larger output. Pels et al. (2003) find increasing returns to scale at European airports in terms of passenger traffic. Martin and Voltes-Dorta (2011a) show that, even for large major hubs around the world, advantages from increasing the scale of operations are still significant. For a large number of airports in Europe it is not possible to reach the minimum scale, for which the generated revenues would cover the fixed and operational costs. A small catchment area and insufficient inbound traffic at such airports can be considered as the most important reasons for such low output levels. This problem leads to a trade-offs: Either a cost efficient airport network can be sustained with a relatively lower number of airports, but then the quality of connectivity would suffer with a less dense airport network. Although competition is shown to increase the productive efficiency (Malighetti et al., 2008; Chi-Lok and Zhang, 2009) or financial efficiency (Starkie, 2008), airports within a network are generally not subject to competition. Instead they rely on joint operational planning with a need for direct or indirect subsidies for ongoing operations. Nonetheless, the negative effects of subsidies on the productive efficiency of firms should not be neglected.

In Norway, for example, the state-owned limited company Avinor AS is responsible for the operations of 46 airports in the country since 2003. The network of airports is characterized by a cross-subsidization scheme, where a few large profitable airports cover the losses of smaller airports, which are also subsidized by the Norwegian Ministry of Transport and Communications through the support of PSO[27] flights. These small airports serve a very low number of passengers (GAP-Project, 2012).

[27] Public Service Obligation

In France, on the other hand, airports are subject to individual ownership and operation, but those airports with financial losses are also in need of financial aid. They rely on direct local or federal government subsidies. The Directorate General of Civil Aviation publishes data over 80 airports annually, 64 out of which serve less than 1 million passengers (DGAC, 2009). Both in Norway and France, airport density is above the European average.[28] The extent of subsidies varies significantly across airports in both countries, with Norway spending a much greater sum. Maximum subsidy per passenger served amounts to approximately 30 euro in France and 185 euro in Norway. In terms of average values, the average subsidy per passenger served equals to 3 euro in France and 26 euro in Norway.[29]

In this research we investigate the determinants of airport unit costs by applying a spatial regression model, which allows for testing the locational interdependence of airports within a country. Next section presents an overview of the literature on airport cost functions as well as on the effect of subsidies on efficiency. In section 3, the research methodology and data are described. The results are illustrated in section 4, followed in the last section by concluding remarks and directions for further research.

4.2 Literature Review

The study of airport cost functions has attracted less attention until the 2000s, mainly due to methodological complexities and the detailed data requirements. Cost functions took either a translog or a Cobb-Douglas form. While some research has focused only on short-run cost function, others have estimated long-run cost functions allowing for variations in the assumed inputs. In most of these studies, "number of passengers" (PAX), "number of air traffic movements" (ATM) and "freight" were used as the outputs produced by an airport in multiple-output models. Often one of these variables has been used as the only output, indicating a single-output production technology. Labor, capital and material have mostly been used as

[28] http://en.worldstat.info/Europe/List_of_countries_by_Number_of_airports_per_million_persons
[29] Although we do not have data on all subsidized airports in France, these summary figures enlighten the situation in comparing the two countries with respect to subsidy levels.

inputs of airports, but the proxies used for inputs have changed according to the data availability.

In the literature we find that airport cost functions have been estimated to answer a wide range of questions concerning managerial, economic, social and political practices. Carlin and Park (1970) studies optimal pricing strategies to overcome the delay problem for LaGuardia airport. Keeler (1970) calculates the marginal costs of runway usage for 13 airport systems in the US and differentiates between capital and operational costs. According to Morrison (1983) cost functions should be estimated with a more sophisticated model that looks at capacity related usage, and the delay costs of the runways. Tolofari et al. (1990) estimate both short and long-run cost functions for 7 British airports, with PAX, ATM and freight as outputs; labor, equipment and capital stock as inputs as well as their prices and various operational attributes of airports. Carlsson (2002) estimates the marginal costs of 19 Swedish airports by using a log-log functional form with PAX as single output. Further, he compares the existing charging structure with marginal-cost prices derived from the analysis. Martin-Cejas (2002) determines the relative efficiency of 40 Spanish airports by estimating a translog cost function with a joint output of passengers and freight transported. The results show that the insufficient airport scale is the main reason behind efficiency differences observed. Craig et al. (2003) also estimate a cost function to compare the efficiency of authority-operated airports with their city-operated counterparts for 53 US airports. The cost function is based on a unique output, namely the ATM and three inputs labor, capital and materials. Main et al. (2003) estimate Cobb-Douglas cost functions for the short and long-run in order to investigate the necessity of a new airport in central Scotland. They conclude that total welfare can be significantly increased in case of developing the existing two airports instead of building a new, larger airport. By using data from 94 US airports Jeong (2005) estimates a translog cost function, in which various operational characteristics are incorporated such as share of international traffic, delay and the level of outsourcing of important activities of the value chain. He finds out that the minimum efficient scale is reached by serving 2.5 million passengers a year. Low and Tang (2006) show the degree of input substitutability at 9 Asian airports by estimating a translog cost function. A stochastic cost frontier in translog form is implemented by Barros (2008) to show the differences in efficiency levels of 27 airports from the United Kingdom. Oum et al. (2008) apply a similar translog cost frontier model to 109 airports worldwide and show that mixed public/private ownership structures lead to the least efficient production structure. Link et al. (2009) estimate the marginal costs for Helsinki airport to show the linear relationship between the number of aircraft movements and the number of employees. McCarthy (2010) estimates a short-run translog cost function for 35 US airports and determines increasing returns to scale in terms of runway utilization. Assaf (2010) utilizes a Bayesian stochastic cost frontier approach by using a Cobb-Douglas form to determine the level of cost efficiency for 13 Australian airports. The results show that none of the airports in the sample can attain the optimal scale. Pels et al. (2010) estimate various specifications of translog cost functions by using a dataset of 36 airports worldwide. Their results indicate the importance of economies of scale. The authors also discuss the infeasibility of marginal cost pricing. Barros (2011) deals with the heterogeneities between the airports in any sample and uses a latent class model to divide the airports into three clusters. After building the clusters, a translog cost function with PAX and ATM as outputs and labor, capital and capital-investment as inputs, is used to identify the efficiency levels for 17 airports in Africa. Martin et al. (2011) estimates various translog cost functions with single and multiple outputs by using data from 36 Spanish airports and conclude that the airports cannot achieve the minimum efficient scale and there exists limited possibility for input substitution. Martin and Voltes-Dorta (2011b) draws similar conclusions on minimum efficient scale with an enlarged dataset of 161 airports worldwide. The same model is implemented by Voltes-Dorta and Pagliari (2012) for 194 airports worldwide to estimate a short-run cost frontier. The authors conclude that the average cost efficiency decreased by 6 percent during the crisis between 2007 and 2009. Martin et al. (2013) use the results of the previous work to implement a second stage regression to measure the cost flexibility of airports and show the disadvantage of higher outsourcing level during a recession.

A look at this literature shows us, that despite addressing similar questions the conclusion may vary depending on the methodology chosen and data implemented. For example, the relationship between costs and the scale of operations is one of the most investigated topics. There is a consensus that airports enjoy scale economies, however the number of passengers necessary to reach efficient scale differs significantly from one study to another.

Furthermore, incorporating airport specific characteristics into cost functions helps to explain the differences in which inputs such as labor, capital and materials are allocated to the production. The literature shows us, that airport costs are driven by external factors, such as traffic structure (percentage of international passengers, percentage of business passengers, LCC share and share of cargo traffic), delays or the degree of competition between airports. The type of ownership and the level of outsourcing also matter. These last two points relate to the governance structure, an issue that we already noted in the study by Oum et al. (2008) concerning the negative effects of mixed ownership. How subsidies affect the operational performance or capital costs has however not been studied. For small airports with inadequate passenger throughput, subsidies play a very important role for their financial survival. Previous research on other industries (including transport sectors) very often point to the adverse effect of subsidies on the operational and capital costs. There has been an extensive research on urban public transport (transit) to find an answer to this question.

Bly et al. (1980) investigate 59 urban public transport companies worldwide and conclude that higher subsidies are associated with higher unit costs and higher number of employees, notwithstanding the positive effects on fares and quality of service. Anderson (1983) explores the changes in governance structure of bus transit companies in the US in detail. By estimating supply and demand equations for the market, the author shows a 28 percent increase in unit operating costs resulting from the introduction of local, state or federal subsidies. Pucher et al. (1983) use multiple regressions to find out the determinants of unit operating costs of urban public transport in the US. Their results indicate that increase in costs accelerated and productivity declines with higher subsidies. They recommend a better monitoring of operations as well as linking these subsidies to specific performance goals. In another paper, Pucher and Markstedt (1983) conduct a comparative analysis of unit costs over ten years for local US bus companies. They show that as the subsidies increased between 1970 and 1980, this led to higher unit costs. They argue that financial support by local governments rather than by the federal governments would enhance efficiency. Besides, performance based subsidies are necessary for better incentives. That, subsidies lead to an increase in unit costs as well as reduction in output per employee for transit companies is also shown by Bly and Oldfield (1986), who expand their study from 1980 to 117 cities. Further, with a time lagged regression they show that the rise in costs follows from a rise in subsidies. Karlaftis and McCarthy (1997) implement a factor analysis method, where they define the quality of transit system in Indiana with efficiency, effectiveness and overall performance. The adverse relationship between the subsidies and performance leads the authors to advocate a performance based subsidy system. In another study Karlaftis and McCarthy (1998) investigate the effects of subsidies and other governance characteristics on costs in transit industry by implementing a fixed effect regression. Their results show that subsidies coming from local, state or federal governments impact the costs differently. Furthermore, Granger causality exists between subsidies and performance. Nolan et al. (2001) estimate relative efficiency scores of transit companies in the US by using a Data Envelopment Analysis (DEA) followed by a second stage regression to determine the factors influencing efficiency. The regression results indicate that the local subsidies increase the efficiency, whereas the federal ones work in negative direction.

How subsidies influence the costs has also been examined for other industries. For instance, Oum and Yu (1994) conduct a DEA for 19 railway companies from OECD countries and test the determinants of efficiency with a second stage tobit regression. According to their results, subsidized railways achieve lower efficiency scores than their unsubsidized counterparts. Cowie (2009) investigates British train operating companies. After the privatization, the government gradually decreased the subsidies to these companies. A DEA Malmquist Index shows that the efficiency changes were positively influenced by the reductions in subsidies. Bergström (2000) analyzes a similar question on the relationship between capital subsidization and firm performance for manufacturing industry. By employing a statistical model with data from Swedish manufacturing companies he concludes that there is a little evidence for a positive effect of capital subsidies on the productivity. Tzelepis and Skuras (2004) use a regression analysis for Greek food and drink-manufacturing sector and show that regional capital subsidies positively influence growth, but have insignificant effects on efficiency and profitability.

In the light of this literature on other industries, we expect to also find a positive relationship between subsidization and the level of costs for airports. Independent of the causality between those two variables with respect to the direction of the effect, i.e. whether higher costs lead to higher subsidies, or vice versa, it postulates that the incentives created by subsidies influence the costs in an undesirable course.

Further, some Baker and Donnet (2012) propose to promote an overall policy for Australia, in which all the stakeholders including federal, state, local governments as well as industry groups jointly take place in strategic decisions. Cohen (2002) also shows that the airport spending rises/decreases proportionally as airport grants increase/decrease.

The effects of the geographical proximity of airports to each other has been subject to various studies (Barrett, 2000; Pels et al., 2009; Fröhlich and Niemeier, 2011; Lian and Rønnevik, 2011). Yet, the main focus of these studies was to investigate the competition among airports. However, the spatial interdependence of airports relates also to broader topics such as the effects of network characteristics, airline-airport relationship, cost levels and productive efficiency rather than just competition effects. Moreover, Huber (2009) shows that a spatial concentration exists in the European airport network and there is a gap in the airport literature regarding the influence of spatial interdependence on a number of issues. The application of spatial relatedness is therefore an approach which includes geographical, cultural and economic factors in the analysis. First, the closeness between two airports means they are subject to similar geographical, climatic and natural characteristics. For example, airports lying on the oceanic coast in Norway mainly struggle with the frozen runways in winter compared to airports located on mountain ranges having to deal with snow, which leads to distinctly different cost characteristics. Second, spatial proximity also can be an expression of cultural similarities, as the behaviors of economic agents in the same regions of a country appear to be comparable. Last but not least, unique or very close economic conditions such as the GDP, growth rates and purchasing power of inhabitants in the same region make the economic environment, in which the airports work, also very close to each other. With the proposed regression specification we would therefore want to show the statistical significance of the spatial interaction of airports. From an econometric point of view, in addition, ignoring the spatial specifications when constructing the cost model could lead to biased estimates of the coefficients. For these reasons, one has to consider also the effects of the geographical distribution of airports and the spill-overs between them. (Pavlyuk, 2012)

To our knowledge, Pavlyuk (2009) is the first application of spatial econometrics to the airport industry. He investigates the relationship between the competitive pressure on an airport and its efficiency by introducing a new definition of airport catchment area. Pavlyuk (2010) tests whether proximity leads to cooperation or competition among airports in Europe by constructing a stochastic frontier model that incorporates spatial econometrics. The results show that airports located within a distance of 550 km tend to cooperate, while competition starts dominating for airports located within 550 km to 880 km. The stochastic frontier model applied also implies that many airports operate below the production frontier and exhibit high inefficiency levels. In another paper, he makes an extensive review of airport benchmarking literature and shows how the competition among airports was included as an explanatory variable in these studies (Pavlyuk, 2012). Finally, Pavyluk (2013) utilizes various spatial stochastic frontier models by using data from 122 European airports and estimates the production function of airports. A comparison of results from these various models shows the necessity of including the spatial characteristics in the stochastic frontier models, so that the biases can be eliminated from the estimations.

Following this review of the literature we first attempt to integrate the spatial interdependency of airports in the regression identifying the determinants of airport costs. By implementing a spatial regression model, we are able to include information about cost-relatedness between nearby airports resulting from geographical, cultural or economic resemblances. Second, we investigate the effects of airport subsidies on cost efficiency, which have so far been ignored in the literature. Third, we evaluate the level of scale economies at airports.

4.3 Methodology and Data

We introduce the economic interaction between the airports (that is their spatial autocorrelation) and their spatial heterogeneity (i.e. spatial structure) by using the methods of spatial econometrics to explain the determinants of airport unit costs from the perspective of spatial interactions and spatial effects (see Paelinck and Klaassen, 1979; Anselin, 1980, 1988 and 2001; LeSage and Pace (2009) and the references therein). As explained in Chapter 1, a spatial lag, spatial error and cross-regressive model can be formulated as follows:

$$y = \rho \cdot W \cdot y + X \cdot \beta + \Upsilon \cdot W \cdot X + u \tag{4.1}$$

$$u = \lambda \cdot W \cdot u + \varepsilon$$

with $\varepsilon \sim N(0, \sigma_\varepsilon^2 I_n)$

In this research, we implement the specification with $\rho \neq 0$, $\beta \neq 0$ and $\Upsilon = \lambda = 0$, namely a spatial lag model, which presents the spatial impact of the dependent variable in the host region on the dependent variable in the surrounding regions.[30] The extension from a spatial regression model to a spatial panel model is straightforward, as in the case of the extension from a classical regression model to a classical panel model, with the usual model specification of individual effects α_i in fixed-effects model or of the error term $\varepsilon_i = \mu_i + v_{it}$ in the random effects model (see e.g. Anselin, 2001; Elhorst, 2001 and 2003; Anselin et al., 2008; Jeleskovic and Schwanebeck, 2012). It is obvious that the choice of the ''best'' specification of the panel model might not be a trivial task.[31] Hence, we will consider here only the basic specification of the fixed effects model, namely the spatial lag fixed effects model. The estimation of this model was done with Matlab and the codes made by Elhorst (2010) which include already the bias correction procedure of Lee and Yu (2010).

As already mentioned, the critical point of the spatial regression is the weight matrix which has to be assumed as an exogenous one (Anselin, 1980 and 1988). Using a distance matrix for spatial weights, one uses some smooth declining function for individual weights in most cases:

$$w = \frac{1}{d^{\alpha}} \qquad (4.2)$$

where d stands for the distance (e.g. in km) between two spatial units and α is a smooth parameter usually an integer $\alpha = [1,2]$ (Anselin, 1988 and 2002).

However, in the sense of the spatial clustering one can assume that some first kilometers around an airport do not make a difference, and after these first kilometers the impact and catchment area are vanishing in a steep grade, and then kilometers far away do not make a big difference again.[32] Thus, we use a non-linear weighted function of decaying distances which we construct by using a so-called

[30] A region in this context means simply the statistical unit. Again, in our context it is an airport.
[31] Given several possibilities for different specifications for either fixed or random effects models.
[32] See a similar argumentation of Pavlyuk (2009).

sigma-shaped function between two airports i and j as depicted in the following equation:

$$W_{ij} = 1 - \frac{1}{1+a * exp(-b * distance_{ij})} \qquad (4.3)$$

where $i \neq j$, $a > 0$ and $b > 0$ and d_{ij} is the distance between airports i and j measured in km. Next, we deal with the question how to find out the optimal values of a and b. Anselin (2002) points out that, model validation techniques, such as a comparison of goodness-of-fit, can be used to find out the best specification of the weight matrix or the parameter of distance decay function. We use the Akaike information criterion-AIC (Akaike, 1974) to solve the problem of best parameter values in our distance decay function.[33] Hence, parameters a and b are calibrated due to the best value of AIC by estimating the regression model for each combination of a and b values. We apply a grid search algorithm over a and b in such a way that all distance decay functions in the parameter space of a and b are unique.[34] Hence, we do not have the identification problem by the parameters a and b. Finally, we use the row-standardized weight matrix W, where the sum of each row is equal to one (Anselin, 1988 and 2002; LeSage and Pace, 2009).

In this chapter we apply the second specification because of the assumption that the airport unit costs (dependent variable in our model) at nearby locations show similarities to each other because they use the same production technique. Hence, the regression model we use takes the following final specification:

$$y_{it} = \rho W y_{it} + \beta X_{kit} + \alpha_i + \varepsilon_{it} \qquad (4.4)$$

[33] This is applied according to Fotheringham et al. (1998 and 2000) and Eckey et al. (2007). These authors provide for using the AIC to optimize the bandwidth parameter in the distance decay function in a geographically weighted regression approach, which is very similar to our econometric approach used in this research.

[34] We take over the assumptions of Anselin and Bera (1998) that the weights matrix is exogenously incorporated into the model.

where y is the vector of dependent variable for airport i in year t, ρ is the spatial autoregressive parameter, W is the weighted distance matrix, X is a matrix of k independent variables, β is the vector of coefficients to be estimated, α is the fixed effect parameter for each airport i and ε is a vector of independent error terms.

The dependent variable we use in the spatial regression is the unit costs of airport operations (*costppax*), calculated by dividing the total operational costs by the annual number of passengers served. Total operational costs include the labor costs, material costs and outsourcing costs but exclude the depreciation. Hence, the analysis ignores the investments undertaken at the airports and focuses merely on the operational level. The matrix of independent variables composes of 7 variables. A year dummy variable is introduced into matrix of independent variables in order to identify time trend of unit costs (*year*). As we utilize a panel dataset between 2002 and 2010 for Norway and 2002 and 2009 for France, *year* dummy variable controls for the annual changes in average cost levels. To examine how important the scale of operations at an airport for the unit costs is, work load unit (*wlu*) is used as an independent variable. *wlu* is a combination of number of passengers and amount of cargo served by the airport and is a good proxy for the cumulative output of the airport. Due to the fact that there are a lot of small sized airports in our dataset, we expect to find out significant economies of scale. In order to analyze the influence of subsidy levels on the cost efficiency, we follow the idea of Oum and Yu (1994) and calculate the ratio of subsidies to the operational costs (*subs*). This variable shows to what extent the losses are covered by either cross subsidies or direct financial installments.

Although the share of commercial revenues increased on average in the last decade, the aeronautical revenues are the core revenue source of most airports, particularly the smaller regional airports that dominate our sample. These mainly include the fees paid by the airlines for using the airport infrastructure. Especially smaller airports with limited possibilities of generating commercial revenues rely mainly on the aeronautical revenues. Hence, including aeronautical revenues per passenger (*aerrev*) delivers valuable results in interpreting the extent of cost coverage by airport charges. This variable has occasionally been used as a proxy for the level airport charges in the literature (Bilotkach et al., 2012).

In spite of the fact that our dataset comprises of commercial airports, these airports serve non-commercial flights as well. These flights are those which are not authorized for public transportation and include flights such as military, ambulance, school, instruction and general aviation. Non-commercial flights constitute a high share of the traffic at some airports in our dataset. For example for the airports in our dataset they make up one fifth of all the flights in Norway and two thirds of all flights in France in 2009. By including the share of non-commercial air traffic movements in total air traffic (*noncommatm*), we test how these flights drive the airport unit costs.

Whether an airport serves any flights through public service obligation (pso) is included as another dummy variable.

In addition investments in terms of either expansion or modernization will influence the operational costs by altering productivity. By having a capital-intensive production technology, airports can benefit from modernization investments in terms of efficiency. Furthermore, investments directly influence the level of capacity utilization at an airport. For these reasons, the total investments should be included in the regression function. However, the data on such investments are not fully available for the whole period of analysis. For this reason, we include the depreciation per passenger (*depr*) as a proxy of capital.

For the spatial regression analysis two separate data samples, i.e. from Norwegian and French airports, are used: A balanced panel dataset of 41 airports in Norway for the years between 2002 and 2010 and a balanced panel dataset of 26 airports[35] in France between 2002 and 2009. Table 4.1 and 4.2 present the descriptive statistics for the variables.

[35] of which 4 are on the island of Corsica

Table 4.1: Descriptive statistics for Norwegian airports, 2002-2010

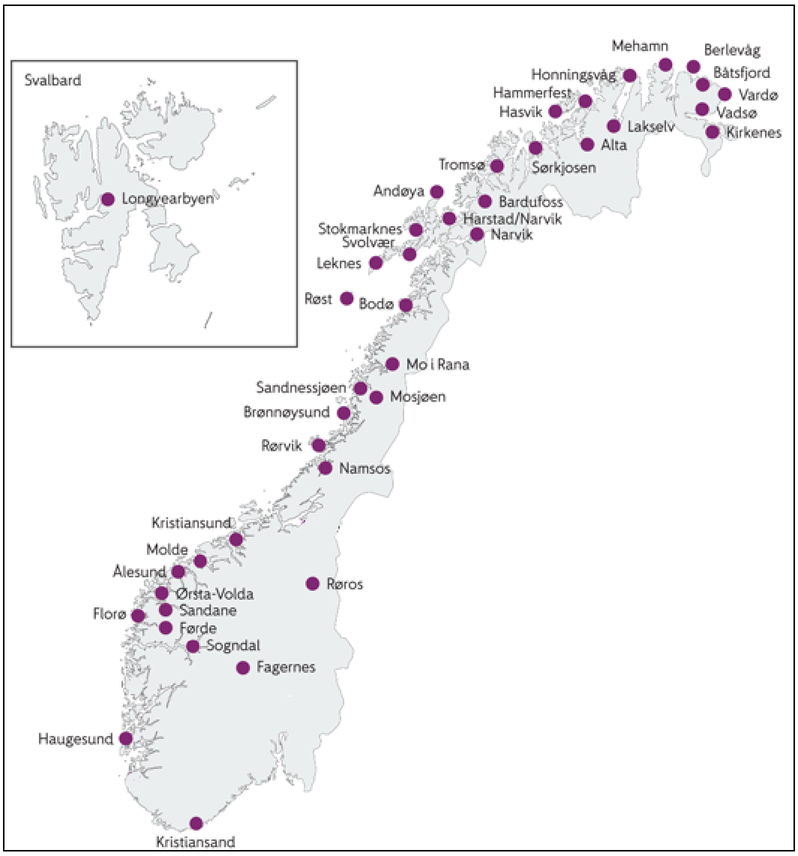
Variable	costppax	wlu	subs	aerrev	noncommatm	pso	depr
Minimum	3.42	5850	0	2.80	0.02	0	0.79
Maximum	247.00	1,649,847	1.50	25.98	0.83	1	142.26
Average	38.62	206,035	0.52	7.91	0.23	0.74	10.50
Stan. Dev.	35.45	342,347	0.31	2.69	0.16	0.44	15.01

Table 4.2: Descriptive statistics for French airports, 2002-2009

Variable	costppax	wlu	subs	aerrev	noncommatm	pso	depr
Minimum	8.25	14,441	0	4.50	0	0	0
Maximum	66.46	7,295,964	0.70	22.15	0.96	1	18.66
Average	16.67	826,325	0.15	8.45	0.66	0.53	3.21
Stan. Dev.	8.89	1,274,584	0.16	1.90	0.26	0.50	2.70

In Figure 4.1, the 41 Avinor airports used in the analysis are shown on the map. Especially on the northern part of the country, the density of the airports is very high. Topographical peculiarities of the country and their social policies towards better connectivity are responsible for such a high number of airports (Lian, 2010). But, on the other hand, total demand is distributed among airports instead of being concentrated at one key airport in a region. Hence, having a close competitor is decreasing the volume of total output at each airport, therefore driving up operating costs per movement.

Figure 4.1: Norwegian airports used in the regression analysis

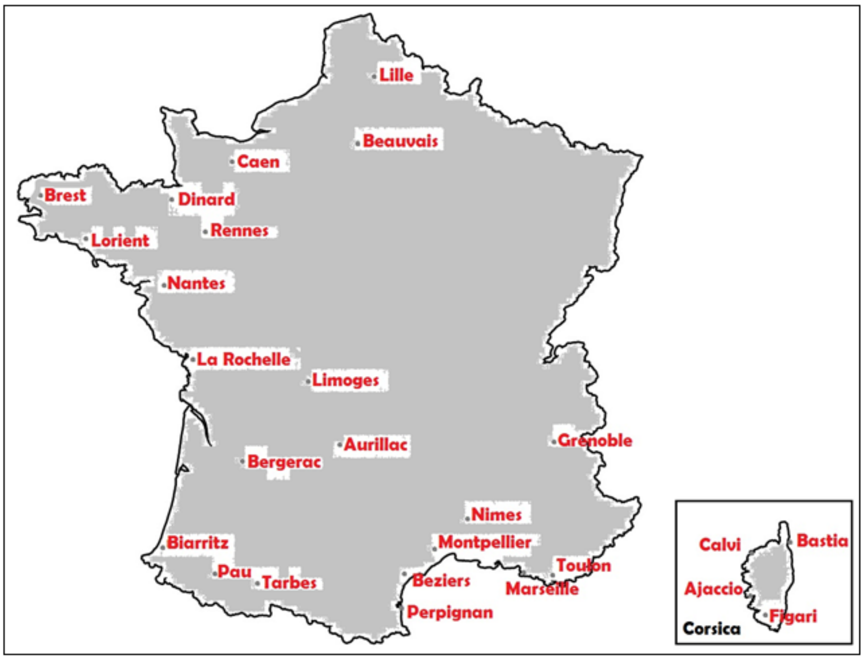


Source: Avinor

Figure 4.2 displays the 26 French airports used in the analysis on the map[36].

[36] It should be noted that the proportion of the airports, which we are able to include in the analysis, in comparison to the total number of airports is very low for France, while in Norway we could obtain data on almost all the airports.

Figure 4.2: French airports used in the regression analysis



Source: own compilation

4.4 Results

Table 4.3 displays the results of the spatial regression analysis from model (4.4) for the airports in Norway and France separately. To start with, we evaluate the results from the spatial perspective by interpreting the coefficient ρ and the corresponding t-values. The coefficient is statistically significant for both countries. This indicates a significant spatial dependence among the airports, as far as the unit operating costs is concerned. Furthermore, the coefficients are positive. Hence, costs of one airport are positively influenced by the weighted average of costs of neighboring airports; that is by the spatial weights matrix W calculated with the Equation (4.3). This, as well, leads to the interpretation that airports located close to each other seem to have similar cost structures. It should be noted that zero values on the diagonal of W matrix assures that the interaction of the same observation in the regression equation is excluded. The coefficient for Norway is significantly higher than that for France, which indicates that the positive correlation between costs of nearby airports in Norway is stronger than in France. It is not a surprising fact, not only because

Norwegian airports are centrally managed by the Avinor Headquarters, but also because Avinor has built four administrative sub-units[37] of its local airports according to their geographical position. This evidently leads to similar management techniques for the airports in the same group. These local airports make up 28 of 41 sample airports; the remaining 13 airports are grouped as national and regional airports. On the other hand, French airports in the sample are managed individually and have no administrative links to each other, which possibly enable them to introduce own strategies regarding the cost structures.[38]

Table 4.3: Estimation results from the spatial regression

Variable	*Norway*	*France*
year	0.050*	0.026*
	(9.23)	(6.46)
wlu	-0.816*	-0.443*
	(-18.81)	(-10.46)
subs	0.203*	0.219*
	(3.87)	(2.76)
aerrev	0.113*	0.223*
	(3.25)	(4.39)
noncommatm	0.229***	-0.266*
	(1.65)	(-2.85)
pso	-0.018	-0.046***
	(-0.67)	(-1.75)
depr	0.032**	0.014***
	(2.20)	(1.71)
$\boldsymbol{\rho}$	0.685*	0.365*
	(12.36)	(3.55)
$\mathbf{R^2}$	0.98	0.94
Adjusted $\mathbf{R^2}$	0.84	0.56
Log-Likelihood	307.00	185.14

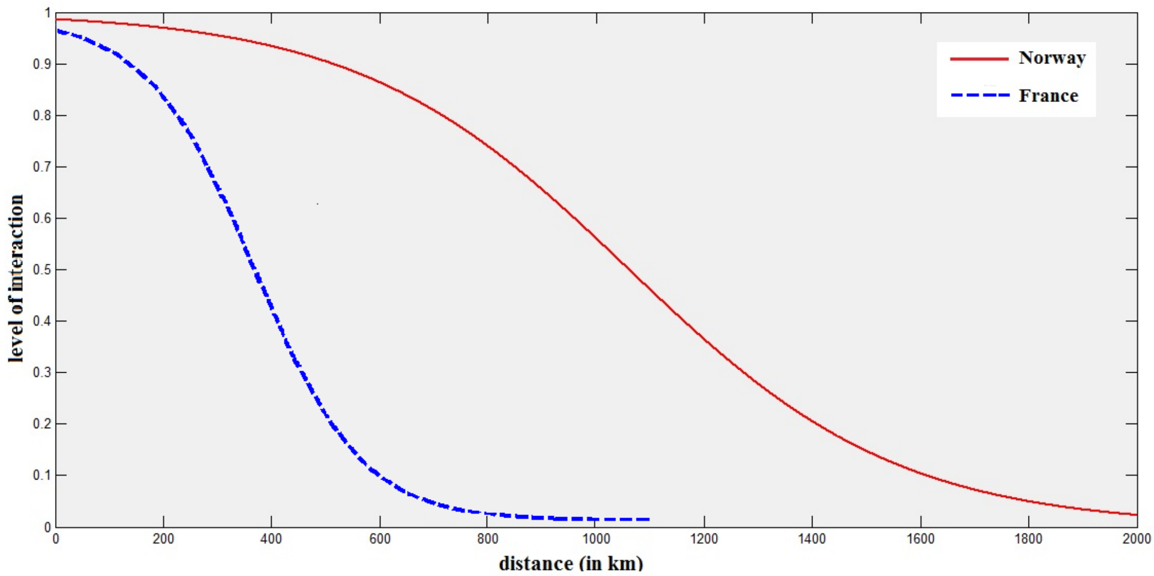
1. Dependent variable is "costppax" (Operating costs per passenger)
2. Independent variables "wlu", aerrev" and "depr" are in natural logarithms.
3. t-values are in parentheses
4. * 1% significance; ** 5% significance; *** 10% significance

[37] These four sub-units are: *Finnmark, Ofoten/Lofoten/Vesterålen, Helgeland/Namdalen* and *Southern Norway*

[38] The private company Vinci has concession contracts for the management of Dinard, Rennes and Nantes airports. However this happened in 2010, after the timeframe of this analysis.

Figure 4.3 plots the interaction level as a function of distance from Equation (4.3) for our sample airports from Norway and France. According to these two figures, the interaction levels remain much higher in Norway, as the distance between airports increases. This leads to the implication that the presence and strength of links between airports in Norway is much higher than in France in our sample.

Figure 4.3: Non-linear weighted functions of decayed distances



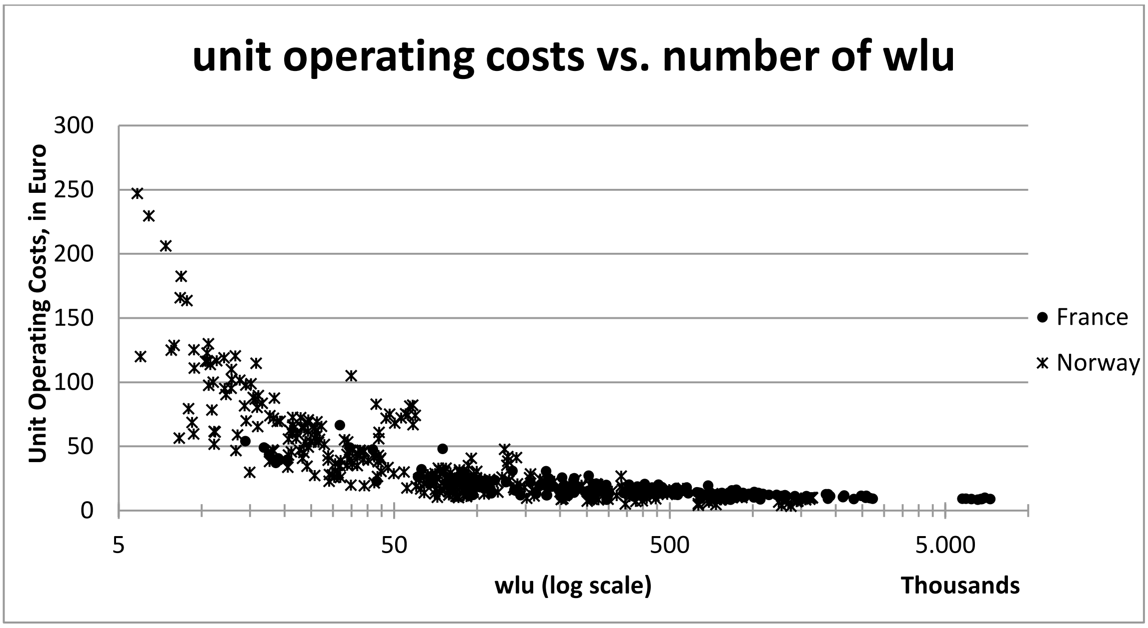
The coefficients for the time trend for both countries are highly significant and have positive signs. It can be concluded that the unit operating costs have increased since 2002. For the 41 Norwegian airports, we observe approximately 5 percent annual increase in average costs. On the other hand, the yearly increase in average costs amounts to 2.6 percent for 26 French airports in the sample[39].

How scale affects the unit operational costs are investigated by using the variable *wlu*. The negative sign of the coefficients for both countries indicates that the unit costs decrease with increasing output, i.e. airport size. One percent increase in the

[39] GAP-Project (2012) finds out that security costs at small Norwegian airports increased more than proportionally between 2002 and 2010, which is a partial explanation of increasing overall costs.

level of *wlu* leads to approximately 0.82 percent decrease in the costs per passenger in Norway and approximately 0.44 percent decrease in France. Figure 4.4 visualizes the relation of unit costs with respect to the airport size, where the unit operating costs are shown against the number of work load units (in log scale). Due to the larger number of very small airports in the sample, Norwegian airports operate on a steeper curve. Especially those airports serving less than 50,000 annual work load units suffer from very high average costs. A detailed analysis of average costs in order to determine the minimum efficient scale of airport operations is beyond the scope of current work and is left for further research.

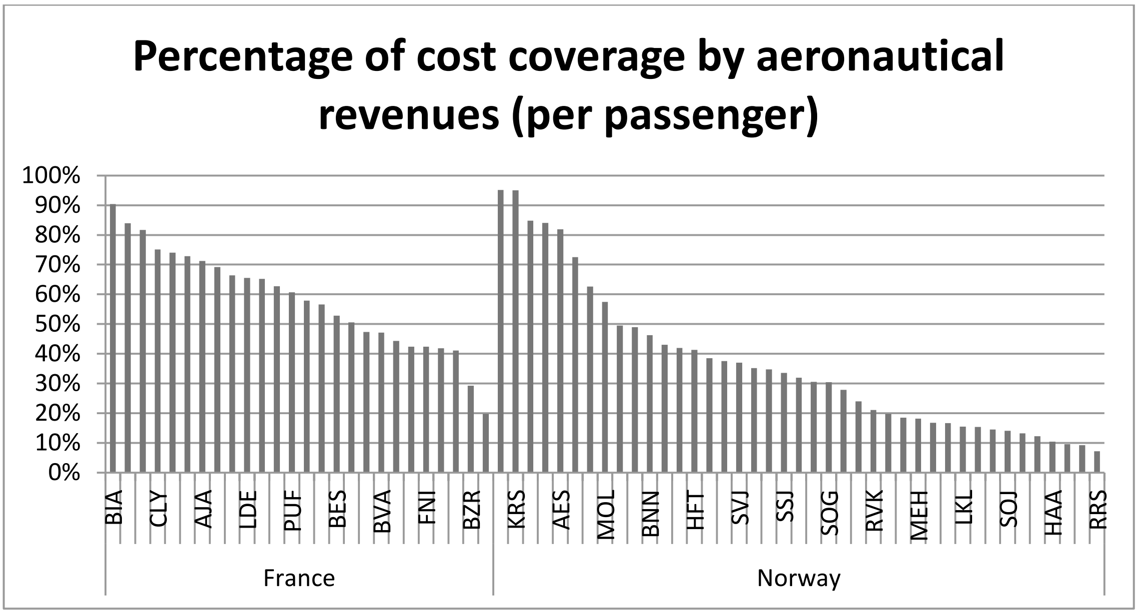
Figure 4.4: Scale effect on unit operating costs



The coefficient of the variable *subs* enables us to confirm the relationship between the level of cost coverage by the subsidies and the unit costs of airports. Having a positive coefficient in both countries indicates that higher subsidies lead to higher unit costs and this relationship is statistically significant. To our knowledge, this is the first attempt in the literature of airport economics, which statistically analyses the relationship between the two variables. The results suggest that if the subsidies relative to costs increase by one percent, the unit costs increase by approximately 0.2 percent both in Norway and France. It should be noted again that the ratio of subsidies to costs is used as the independent variable in the regression, because the absolute values of the subsidies are not relevant due to different scale of various airports.

Next, it can be seen that the revenues from the aeronautical charges per passenger have a significant positive relationship with the unit operating costs by observing the results for the variable *aerrev*. Furthermore direct correlation between the unit costs and aeronautical revenues per passenger amounts to 0.25 in Norway and 0.28 in France. Despite the obtained significant and positive relationship, the coefficients and the correlation values are relatively small indicating that the aeronautical revenues are insufficient, given the operational costs. This raises concerns whether determination of airport charges follow calculations based on the costs. The challenge airport managers are facing is the question to what extent the airport fees can be increased, which are paid by the airline companies. Elasticity of demand for air travel increases as the travel length decreases. Normally for long-haul flights, we observe inelastic demand. However elastic demand can characterize the short-haul flights, because the airport charges constitute a higher proportion of total airline costs. Following this argument, if we assume a price elastic demand of airlines for airport services (Intervistas, 2007; Starkie and Yarrow, 2013), the aeronautical revenues will further decrease when the airport fees are increased and this leads to a vicious circle of whether the aeronautical revenues may be increased at all. The dataset implies no significant relationship between airport size and the share of aeronautical revenues in total revenues. This is driven by the fact that relatively small airports dominate the sample. Figure 4.5 shows that none of the airports in the sample was able to cover the operational costs by the aeronautical revenues on average over the time span. The average value amounts to 36 percent and to 58 percent, for the 41 Norwegian and for the 26 French airports respectively.

Figure 4.5: Relationship between costs and aeronautical revenues, 2002-2009 or 2010



The variable *noncommatm* delivers different results for the two countries regarding the direction of the influence of non-commercial air traffic share on the unit costs. While unit costs increase in Norway with increasing share of non-commercial air traffic, they decrease in France. In order to explain the conflicting results, further analysis regarding the components of non-commercial air traffic is necessary. Despite not having detailed data, we assume that the general aviation traffic constitutes an important part of non-commercial activities at French airports, hence lowering the overall unit costs. In contrast, Norwegian airports serve mainly other type of non-commercial activities such as ambulance flights.

Some airports benefit from the centrally-organized and government-subsidized PSO routes by increasing the number of passengers served. These services help airports improve the unfavorable situation of having too little traffic, which leads to higher average costs. Furthermore some airports entirely rely on PSO flights. Regression results deliver negative coefficients for the *pso* variable. In France, an airport with PSO flights operates with 4.6 percent less average costs than those airports without any PSO flights. We observe the same, but weaker, relationship for Norway as well, however the coefficient is statistically insignificant.

Finally, the coefficients of the variable *depr* are positive indicating that the value of depreciation per passenger influences the average costs in the same year positively. The interpretation of the positive coefficients is somewhat difficult, but intuitionally one can explain this with the lagged effect of investments on the unit costs. It is to say, some investments require a couple of years to be utilized effectively. Furthermore the lumpiness of airport investments such as runway or terminal expansions leads to lower capacity utilization in the time period following the investment. The higher unit costs might be associated with the low utilization of capacity at those airports, which undertook recent expansions. In addition, the coefficients of the depreciation variable are significant only at 5 and 10 percent levels for Norway and France respectively. It can be driven by the fact that that there is no differentiation in the depreciation data with regard to the lifetime of the investment made. Both small investments such as computers or office supplies and large investments such as for runways and terminals are included in the depreciation data. A further distortion to the depreciation data relates to the establishment of Avinor in 2003, which from then on was responsible for the whole airport infrastructure in the country. Upon establishment Avinor made an immense investment to improve the infrastructure at airports that where before operated by the communes or regional bodies. This led to a sudden jump in the data for depreciation[40].

4.5 Conclusion and Directions for Further Research

Our study is based on two separate data samples that consisted of subsidized airports in Norway and France, with which a number of hypotheses could be tested. The spatial lag regression model indicated a significant level of spatial relatedness among airports, namely the spatial impact of the dependent variable (unit costs) at the host airport on the unit cost of the surrounding airports. We also studied the

[40] Total depreciation for the 41 airports in the sample increased by approximately 53 percent between 2002 and 2003.

relationship between subsidies and costs as well as the importance of scale economies. Furthermore, the annual changes in average cost levels, cost coverage via aeronautical revenues, importance of non-commercial air traffic movements, the effects from PSO routes and the level of investments were evaluated in this research.

The unit costs of airports show a statistically significant level of spatial interdependencies which was estimated by the ρ variable in the regression specification. The spatial relationship in Norway is much stronger than in France. Thus, it can be concluded that once the airports are managed as a group, the interaction among them tend to be stronger mainly due to the organizational similarities. Although competition is assumed to improve the cost efficiency, one should treat this issue with special care and evaluate the spatial distance between airports in detail. In terms of overlapping catchment areas, where airports are located very close to each other with limited aggregate demand in the area, positive effects due to competition are offset by factors like insufficient exploitation of scale that lead to negative results in terms of the costs, or technical efficiency of airports.

From a methodological point of view, the significance of the results of the spatial parameters indicates that the model specification enables us to avoid biased estimates. An F-test can be implemented to test the efficiency of the model in comparison to a non-spatial regression specification. However, in further research indirect effects should be introduced in order to improve the analysis. These include the secondary relationships between a host airport and a third airport, where the spatial dependence of unit costs is transited via an airport located between those two airports. Nonetheless it is believed that these effects would only lead to negligible changes in the results we have obtained.

The significant positive relationship between the share of costs covered by the subsidies and the unit costs indicate that subsidies may provide distorted incentives. Thus policies regarding the subsidization of airports and routes should be re-evaluated. Subsidization policies should include mechanisms, which will better align the incentives of the airports with the government rather than merely encouraging non-market driven traffic as riskless financial support. Moreover, fiscal decentralization would enhance the way subsidies are allocated to the necessary nodal point, which should replace the centrally organized installments to cover any expenses accrued at an airport. For instance, the local governments can be endowed with a yearly sum of financial support and the allocation between different nodes of public good provision such as airports; ports; highways; rail or water, gas and electricity infrastructure should be undertaken according to the needs of the region. Another, but a similar option would be to decide the level of subsidy each airport will receive prospectively, rather than paying for the costs ex-post irrespective of the magnitude. We believe that the causality between the two should be investigated in more detail by applying a more in-depth regression analysis, in which time lagged variables can determine the direction of the causal links as well as a Granger-causality test.

Inadequate demand at the airports is the most important reason behind high unit costs. Some airports are not able to achieve a break-even point due to scale, although they might be technically efficient with regard to the input output combinations chosen. Hence, policies towards increasing the demand for the airport services on the one hand and closing very small airports on the other can help to overcome this problem. In most of the airports, traffic is considered to be an exogenous variable, on which the managers have no influence. Bel (2009) defines this situation for Spanish airports as "a hand tied behind back", however presents the example of Girona, where local institutions express a great interest in the situation of the airport due to financial spillover effects in the region. In addition, airline-friendly policies are applied by the airport. These resulted in a tenfold increase in the number of passengers served. However, it should be kept in mind that such policies should be applied with a special care. Girona airport almost exclusively relied on the services by its main customer Ryanair, which constituted approximately 90 percent of the total traffic in 2007. Such a dependency on a single customer certainly leads to concerns about a sustainable business model. Nevertheless, Ryanair started reducing the offers from or to Girona airport, reducing the total number of passengers at the airport continuously after 2009.

In some other cases, traffic stimulation via PSO grants appears to be the only solution to increase the demand at the airports. However, our results show that the unit costs at PSO airports are not statistically different than those at other airports in Norway. This is in line with the results of Pita et al. (2014), who suggest that the PSO system in Norway can be enhanced. In France, on the other hand, PSO services seem to improve the airport unit costs. Airports with PSO share tend to operate with approximately 4.6 percent lower unit costs. Precise information about the PSO shares for the airports would further enhance the analysis.

As regards scale economies, it should finally be noted that an estimation as to the minimum efficient scale of operations at the airports was not undertaken in this research, because based on previous literature it is assumed that the airports in the sample serve a very low number of passengers, so that the results of such an analysis could not be generalized to larger airports.

Low capacity utilization accelerates the problems with respect to high unit costs, as shown with the depreciation variable in our regression specification. From this finding, it can be concluded that an optimal long-term strategy for small-sized airports should be not to increase the capacity unless a certain threshold for the utilization of current capacity is reached.

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Data and Intermediate Calculations of the Analyses

Appendix to Chapter 2

Due to the confidentiality of data in this chapter the raw data cannot be published. However, the whole dataset is available on request with the condition of confidentiality. Please contact Tolga Ülkü (tolga.ulku@yahoo.com) and Prof. Dr. Hans-Martin Niemeier (Hans-Martin.Niemeier@hs-bremen.de)

Appendix to Chapter 3

Raw data for the Spanish airports are publicly available in the webpage of AENA (in Spanish language) and can be found under the following links[41]:

http://www.aena-aeropuertos.es/csee/ccurl/674/66/Resultados%20Aeropuertos%202009.pdf

http://www.aena-aeropuertos.es/csee/ccurl/572/645/Resultados%20Aeropuertos%202010.pdf

http://www.aena-aeropuertos.es/csee/ccurl/227/259/CTA_RES_AEROPUERTOS_2011_OFICIALES_29JUNIO.pdf

Raw data for the Turkish airports are updated every year in the webpage of DHMI under the following link:

[41] In the dissertation, published provisional data for the year 2011 were used. There is a very small change in Algeciras-Heliport in the finalized dataset by AENA, however it does not affect the results, because the mentioned Heliport was not included in the analysis.

http://www.dhmi.gov.tr/finans.aspx#.VFe9afmImx0[42]

The historical raw data for the years 2009-2011 used in the dissertation can be found under the following link:

https://www.dropbox.com/sh/rsqivjd11fhewhe/AACxF20gVix6VDteMu8dncDea?dl=0

Summary statistics

	Country	Staff costs (euro)	Other costs (euro)	Runway area (sqm)	Total revenues (euro)	Passengers	Air traffic movements	Cargo (tons)
Average	**Spain**	8,448,891	19,820,904	145,432	39,035,718	3,549,593	38,554	6,655
	Turkey	7,367,588	10,135,847	185,888	24,393,013	2,020,378	17,466	1,885
Minimum	**Spain**	707,847	1,084,499	37,500	141,569	7,852	937	0
	Turkey	1,008,317	1,645,538	69,000	120,206	15,267	419	0
Maximum	**Spain**	46,656,306	228,143,370	474,480	479,582,754	34,398,226	303,054	104,280
	Turkey	49,176,786	116,877,030	440,550	459,291,666	25,027,657	164,732	17,725

[42] AENA and DHMI webpages containing the data were visited last on 27.11.2014

Input-output variables used in the DEA[43]

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
ABC2009	1,050,252	1,438,389	162,000	182,653	15,127	1,419	0
ABC2010	1,079,969	1,361,210	162,000	224,993	11,293	1,243	0
ABC2011	882,086	1,241,455	162,000	141,569	8,415	937	0
ACE2009	8,995,637	23,276,782	108,000	44,258,992	4,701,669	42,915	4,147
ACE2010	9,134,735	21,171,885	108,000	45,527,427	4,938,343	46,669	3,787
ACE2011	9,408,922	23,685,653	108,000	52,053,988	5,543,744	49,675	2,873
AGP2009	24,806,497	70,686,530	144,000	139,398,130	11,622,429	103,539	3,405
AGP2010	26,639,226	75,462,807	144,000	141,487,138	12,064,521	105,634	3,064
AGP2011	26,974,420	80,814,360	144,000	165,919,363	12,823,117	107,397	2,992
ALC2009	17,100,843	35,309,018	135,000	102,684,971	9,139,479	74,281	3,200
ALC2010	18,078,225	31,319,090	135,000	104,363,217	9,382,931	74,476	3,113
ALC2011	18,327,795	42,655,956	135,000	122,261,531	9,913,731	75,576	3,012
BCN2009	46,656,306	213,634,969	474,480	353,398,405	27,421,682	278,981	89,815
BCN2010	45,234,935	228,143,370	474,480	375,885,326	29,209,536	277,832	104,280
BCN2011	45,258,655	224,648,894	474,480	479,582,754	34,398,226	303,054	96,573
BIO2009	8,162,285	19,167,100	207,000	44,658,544	3,654,957	54,148	2,691
BIO2010	8,695,997	17,436,993	207,000	47,259,877	3,888,955	54,119	2,548
BIO2011	8,679,295	17,456,599	207,000	49,331,499	4,046,172	54,446	2,634
BJZ2009	924,678	1,084,499	171,120	696,363	75,351	3,783	0
BJZ2010	866,225	1,271,213	171,120	989,971	61,179	3,411	0
BJZ2011	707,847	2,580,919	171,120	620,727	56,981	2,957	0

[43] {I}: Input, {IN}: Non-discretionary input, {O}: Output, {ON}: Non-discretionary output

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
EAS2009	3,356,240	4,029,772	78,930	3,219,251	315,294	9,743	31
EAS2010	3,273,655	3,566,146	78,930	3,037,412	286,077	9,581	19
EAS2011	3,016,518	3,364,996	78,930	2,580,919	248,050	9,560	32
FUE2009	8,436,264	20,126,026	249,570	36,918,643	3,738,492	36,429	1,913
FUE2010	8,302,259	17,020,755	249,570	41,455,045	4,173,590	39,437	1,711
FUE2011	8,570,395	20,189,978	249,570	50,768,973	4,948,018	44,549	1,558
GMZ2009	1,198,657	3,892,782	45,000	593,621	34,605	1,917	11
GMZ2010	1,304,962	3,352,403	45,000	641,231	32,488	1,776	9
GMZ2011	1,088,996	2,395,790	45,000	631,617	32,713	1,769	8
GRO2009	7,454,507	13,516,287	108,000	45,297,828	5,286,970	48,127	71
GRO2010	7,346,037	11,418,418	108,000	42,310,020	4,863,954	43,291	63
GRO2011	7,078,471	12,937,267	108,000	27,399,128	3,007,977	27,799	62
GRX2009	5,102,855	7,557,249	130,500	11,004,815	1,187,813	16,300	41
GRX2010	5,141,101	6,626,057	130,500	9,652,219	978,254	13,843	38
GRX2011	4,813,360	6,403,294	130,500	8,396,156	872,752	13,142	34
IBZ2009	11,233,131	20,993,626	126,000	39,019,147	4,572,819	53,552	3,144
IBZ2010	11,384,669	16,953,257	126,000	41,758,786	5,040,800	56,988	2,996
IBZ2011	11,576,023	23,239,165	126,000	51,934,198	5,643,180	61,768	2,755
LCG2009	4,806,045	8,093,790	87,210	11,244,547	1,068,823	16,236	240
LCG2010	5,197,349	8,909,741	87,210	11,474,667	1,101,208	17,378	245
LCG2011	4,976,710	8,352,596	87,210	11,456,233	1,012,800	16,283	252
LEI2009	5,879,128	7,854,059	144,000	10,068,721	791,837	15,391	16
LEI2010	5,433,592	7,199,791	144,000	9,967,210	786,877	16,112	14
LEI2011	4,835,140	7,220,041	144,000	9,060,443	780,853	14,946	10
LEN2009	2,123,336	1,792,278	135,000	970,342	95,189	4,773	4

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
LEN2010	2,114,939	1,912,444	135,000	1,361,210	93,373	4,773	4
LEN2011	1,862,182	1,720,613	135,000	1,252,345	85,725	4,461	7
LPA2009	18,950,200	43,471,303	279,000	88,426,658	9,155,665	101,557	25,995
LPA2010	19,979,419	34,761,490	279,000	89,682,394	9,486,035	103,093	24,528
LPA2011	20,505,786	42,024,339	279,000	108,333,278	10,538,829	111,271	23,679
MAH2009	10,182,879	17,009,517	209,250	22,100,957	2,433,666	28,189	2,621
MAH2010	10,023,459	11,868,405	209,250	22,443,098	2,511,629	28,358	2,400
MAH2011	9,757,400	14,450,971	209,250	25,700,295	2,576,200	28,042	2,071
MJV2009	4,201,008	5,217,013	104,400	15,502,634	1,630,684	15,900	9
MJV2010	4,308,625	6,029,825	104,400	13,420,860	1,349,579	13,477	3
MJV2011	4,279,753	5,837,016	175,365	12,447,219	1,262,597	12,712	1
MLN2009	3,299,161	5,742,139	61,695	1,986,346	293,695	9,245	351
MLN2010	3,217,406	5,096,102	61,695	1,833,697	292,608	8,935	341
MLN2011	2,994,738	4,780,690	61,695	1,764,173	286,701	9,119	266
ODB2009	2,009,178	1,449,804	62,100	456,631	15,474	8,650	0
ODB2010	2,159,937	1,732,450	62,100	809,976	7,852	7,095	0
ODB2011	1,960,192	1,502,814	62,100	555,388	8,442	7,273	0
OVD2009	5,742,139	7,557,249	99,000	13,607,614	1,316,212	16,033	113
OVD2010	5,512,340	7,008,546	99,000	14,174,588	1,355,364	16,538	111
OVD2011	5,728,117	8,319,926	99,000	13,568,885	1,339,010	15,348	137
PMI2009	29,646,789	91,965,551	282,150	196,751,026	21,203,041	177,502	17,086
PMI2010	29,924,130	72,639,139	282,150	192,909,394	21,117,417	174,635	17,292
PMI2011	29,435,550	95,548,470	282,150	228,514,828	22,726,707	180,152	15,777
PNA2009	3,995,524	4,657,640	99,000	3,401,903	335,612	11,690	45
PNA2010	3,869,888	4,252,376	108,225	3,104,910	291,553	10,456	43

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
PNA2011	3,604,575	4,323,312	108,225	2,493,800	238,511	9,604	34
REU2009	5,445,329	12,340,462	110,655	14,326,808	1,706,615	30,946	10
REU2010	5,107,352	7,874,771	110,655	12,217,145	1,419,851	26,520	246
REU2011	5,129,169	8,319,926	110,655	11,445,343	1,362,683	21,494	35
RGS2009	1,084,499	2,579,967	94,500	285,395	27,716	3,571	0
RGS2010	1,136,217	2,846,167	94,500	337,490	33,595	3,560	2
RGS2011	860,306	2,286,891	94,500	250,469	35,447	3,961	0
RJL2009	1,461,220	3,379,072	99,045	570,789	35,663	5,023	0
RJL2010	1,496,207	3,937,386	99,045	416,238	24,527	3,638	0
RJL2011	1,241,455	4,007,504	99,045	381,148	17,877	2,734	0
SCQ2009	8,379,185	13,447,793	144,000	20,251,600	1,944,068	20,166	1,989
SCQ2010	9,337,229	11,632,162	144,000	22,679,341	2,172,869	21,252	1,964
SCQ2011	9,212,902	14,853,899	144,000	28,368,334	2,464,330	22,322	1,788
SDR2009	4,554,898	5,057,192	104,400	8,322,106	958,157	18,756	11
SDR2010	4,409,872	5,208,599	104,400	7,998,518	919,871	16,667	2
SDR2011	4,312,422	4,552,001	104,400	9,060,443	1,116,398	17,072	1
SLM2009	1,803,694	1,700,952	150,780	787,689	53,088	12,832	0
SLM2010	1,799,948	1,541,205	150,780	753,728	43,179	12,244	0
SLM2011	1,611,713	3,114,527	150,780	566,278	37,257	12,538	0
SPC2009	5,970,455	9,669,168	99,000	7,648,575	1,043,274	19,742	1,084
SPC2010	6,266,068	8,988,489	99,000	7,987,268	992,363	19,256	941
SPC2011	5,336,078	10,835,506	99,000	8,221,916	1,067,431	19,455	852
SVQ2009	12,420,372	24,578,182	151,290	46,450,822	4,051,392	55,601	4,983
SVQ2010	12,678,382	21,250,632	151,290	46,641,144	4,224,718	54,499	5,467
SVQ2011	12,828,368	20,712,696	151,290	52,957,854	4,959,359	56,021	5,127

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
TFN2009	9,543,595	18,562,064	142,695	31,267,831	4,054,147	62,776	18,305
TFN2010	9,697,218	15,693,294	142,695	30,430,366	4,051,356	61,605	15,938
TFN2011	9,909,860	18,926,743	142,695	33,911,322	4,095,103	62,604	15,745
TFS2009	18,459,322	35,936,886	144,000	82,821,508	7,108,055	49,779	5,371
TFS2010	18,843,202	27,302,957	144,000	84,912,532	7,358,986	51,858	4,294
TFS2011	18,850,513	31,711,551	144,000	102,147,783	8,656,487	58,093	4,480
VDE2009	2,146,167	4,977,282	37,500	1,016,005	183,891	4,341	154
VDE2010	2,148,688	4,016,133	37,500	1,158,716	170,968	4,142	145
VDE2011	1,840,402	4,257,973	37,500	1,012,766	170,225	4,674	135
VGO2009	4,943,034	8,105,206	108,000	11,997,988	1,103,285	15,698	797
VGO2010	5,219,848	8,606,000	108,000	11,722,159	1,093,576	14,941	901
VGO2011	5,303,408	13,405,535	108,000	10,280,118	976,152	14,130	1,114
VIT2009	7,454,507	7,397,428	157,500	3,458,982	39,933	9,490	27,388
VIT2010	7,492,282	6,704,805	157,500	3,487,399	42,073	6,742	27,961
VIT2011	6,926,012	5,902,356	157,500	3,288,767	28,211	7,582	34,692
VLC2009	11,472,862	30,343,152	144,675	58,163,416	4,748,997	81,126	9,792
VLC2010	11,632,162	23,376,821	144,675	58,464,551	4,934,268	77,806	11,428
VLC2011	12,153,190	23,794,553	144,675	62,355,886	4,979,511	70,397	10,509
VLL2009	3,447,567	2,796,867	135,225	3,653,051	365,720	9,236	75
VLL2010	3,464,899	2,598,674	135,225	3,937,386	392,689	8,974	32
VLL2011	3,277,877	4,573,781	135,225	3,691,695	462,504	9,079	46
XRY2009	6,038,949	13,904,424	103,500	12,945,498	1,079,616	43,326	121
XRY2010	5,737,333	11,485,916	103,500	12,723,380	1,043,163	33,395	128
XRY2011	5,227,179	10,530,587	103,500	11,695,812	1,032,493	41,713	54
ZAZ2009	4,920,203	4,817,461	303,750	7,340,349	528,313	12,750	36,890

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
ZAZ2010	4,724,863	5,152,350	303,750	7,694,776	605,912	12,714	42,543
ZAZ2011	4,595,561	6,642,873	303,750	8,494,165	751,097	11,970	48,647
ADA2009	11,432,377	10,395,630	123,750	17,847,825	2,482,402	26,242	5,559
ADA2010	12,658,359	9,116,114	123,750	18,985,687	2,841,170	30,342	8,460
ADA2011	14,243,492	9,494,745	123,750	22,299,005	3,240,967	34,966	5,661
ADB2009	22,818,729	32,726,158	291,600	52,283,771	6,201,794	54,197	13,471
ADB2010	24,590,365	21,855,302	291,600	59,540,492	7,485,098	63,178	17,725
ADB2011	28,321,784	23,134,046	291,600	72,799,981	8,523,533	70,327	16,592
ADF2009	1,606,321	1,645,538	75,000	263,914	85,112	880	50
ADF2010	1,841,115	1,665,070	75,000	507,113	108,507	1,124	57
ASR2009	2,963,584	8,955,617	135,000	7,367,018	778,639	7,281	277
ASR2010	3,517,200	8,818,309	135,000	7,401,056	940,245	8,596	325
ASR2011	4,297,103	9,003,083	135,000	8,824,926	1,223,760	10,991	354
AYT2009	19,441,732	65,994,388	440,550	353,794,372	18,345,693	127,236	6,857
AYT2010	21,702,749	67,609,539	440,550	408,300,104	22,013,027	148,821	8,900
AYT2011	24,372,951	116,877,030	440,550	459,291,666	25,027,657	164,732	7,406
BJV2009	9,245,770	17,491,535	135,000	56,160,899	2,780,944	23,471	238
BJV2010	9,755,403	16,932,862	135,000	61,902,489	3,085,187	25,816	138
BJV2011	11,192,169	16,669,645	135,000	69,330,888	3,388,335	27,963	125
DIY2009	3,484,200	4,076,314	159,705	4,563,850	1,060,381	8,897	950
DIY2010	3,800,468	3,869,045	159,705	4,867,671	1,404,590	11,335	1,010
DIY2011	3,976,326	4,822,263	159,705	6,280,352	1,733,374	13,909	904
DLM2009	11,910,700	13,472,593	270,000	45,639,376	3,347,996	24,014	502
DLM2010	12,612,547	12,463,074	270,000	42,033,047	3,785,779	27,070	186
DLM2011	14,047,539	12,188,679	270,000	42,344,222	3,732,374	27,865	201

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
DNZ2009	2,569,810	5,678,234	135,000	907,638	150,780	1,774	0
DNZ2011	3,554,711	7,045,016	135,000	969,808	174,627	2,299	167
ERC2009	2,041,028	3,651,417	135,000	490,446	127,030	1,667	6
ERC2011	2,951,632	6,025,988	135,000	772,889	207,074	2,487	30
ERZ2009	4,966,233	5,748,300	285,750	3,117,930	599,017	5,230	32
ERZ2010	5,703,598	4,953,990	285,750	3,619,538	765,082	6,828	32
ERZ2011	7,090,204	7,173,882	285,750	4,286,020	805,337	7,861	369
ESB2009	38,240,231	27,863,017	393,750	38,690,163	6,084,404	62,620	13,441
ESB2010	42,762,930	23,803,975	393,750	38,650,986	7,763,914	73,929	15,095
ESB2011	49,176,786	25,835,466	378,000	47,920,482	8,485,467	82,965	15,215
EZS2009	3,598,634	2,758,524	231,000	741,075	344,844	2,544	105
EZS2010	4,143,935	2,935,663	135,000	1,345,548	470,049	4,260	187
EZS2011	4,812,429	3,141,240	135,000	2,160,394	549,054	4,577	184
GNY2009	3,584,527	10,251,653	180,000	780,312	181,155	1,914	27
GNY2010	3,629,508	10,059,327	180,000	1,107,569	221,034	2,644	61
GNY2011	4,146,557	9,860,494	180,000	1,206,121	231,323	2,474	72
GZT2009	6,480,616	9,013,915	234,000	5,806,229	833,002	8,161	808
GZT2010	6,994,523	9,506,239	234,000	6,929,099	1,039,972	10,418	918
GZT2011	8,096,801	9,699,246	234,000	8,976,102	1,314,508	13,099	1,072
HTY2009	1,763,437	4,272,586	135,000	1,188,124	325,307	3,102	29
HTY2010	2,168,914	4,672,870	135,000	2,642,095	574,613	5,573	157
HTY2011	3,204,752	6,018,267	135,000	4,775,707	689,586	6,343	64
ISE2010	2,744,932	4,102,041	135,000	500,541	33,411	5,821	1
KCM2009	2,056,565	1,959,573	69,000	150,750	81,420	1,133	26
KCM2011	2,706,126	2,193,608	103,500	302,435	95,740	1,492	60

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
KSY2009	2,475,926	3,149,679	157,500	854,732	288,008	2,276	37
KSY2010	2,832,319	2,973,347	157,500	1,080,707	332,286	2,798	36
KSY2011	3,279,518	3,503,900	157,500	1,266,047	377,584	2,978	39
KYA2009	3,120,631	2,934,935	301,500	1,492,394	301,724	4,050	0
KYA2010	3,829,969	3,241,811	301,500	2,016,025	545,497	6,393	16
KYA2011	4,917,883	3,716,816	301,500	3,180,035	600,871	6,520	101
MLX2009	2,306,095	2,314,644	150,750	1,944,110	462,884	4,566	413
MLX2010	2,970,734	2,789,523	150,750	2,295,314	520,457	5,961	302
MLX2011	3,605,148	3,935,825	301,500	2,627,100	570,605	6,936	310
MQM2009	1,332,071	3,615,380	90,000	448,563	233,288	2,098	0
MQM2010	1,563,628	3,927,832	150,000	889,753	305,914	2,839	189
MSR2009	1,265,205	1,921,281	159,750	460,360	115,795	1,111	13
MSR2010	1,526,969	2,080,097	159,750	593,477	179,808	1,761	28
MSR2011	1,839,512	2,078,596	159,750	706,440	196,546	1,804	53
MZH2009	1,008,317	1,843,258	131,715	120,206	39,577	419	3
MZH2010	1,421,708	1,894,533	131,715	255,932	64,393	654	4
NAV2009	4,328,160	4,513,371	135,000	356,563	122,753	1,524	28
NAV2010	4,563,460	4,027,003	135,000	709,707	137,909	1,753	0
NAV2011	5,040,336	4,238,144	135,000	882,928	157,792	2,017	8
SZF2009	6,178,745	7,676,896	135,000	5,249,997	866,862	7,856	61
SZF2010	6,435,929	7,866,146	135,000	5,864,714	957,391	9,317	0
SZF2011	6,920,074	7,948,063	135,000	6,410,712	1,155,158	10,614	336
TEQ2009	2,716,110	4,476,815	135,000	1,123,490	40,778	17,481	1,315
TEQ2010	3,061,898	4,057,521	135,000	2,655,680	74,404	20,252	3,340
TEQ2011	3,808,624	4,788,665	135,000	2,932,822	43,120	23,207	1,854

DMU	StaffC {I}	OtherC {I}	Rwy {IN}	TotRev {O}	PAX {ON}	ATM {ON}	Cargo {ON}
TZX2009	7,077,781	11,410,732	118,800	11,641,699	1,596,905	14,892	1,446
TZX2010	7,790,140	11,435,766	118,800	11,748,702	1,963,169	17,795	2,009
TZX2011	9,051,921	11,931,991	118,800	13,277,571	2,280,017	19,554	2,858
USQ2011	2,334,283	1,795,266	115,200	144,774	15,267	706	0
VAN2009	3,052,029	3,995,127	123,750	2,320,156	745,493	6,720	491
VAN2010	3,566,400	3,814,630	123,750	3,267,596	892,050	7,923	743
VAN2011	4,333,554	4,453,022	123,750	3,980,584	1,057,132	10,270	1,272
VAS2009	1,920,405	2,946,318	114,330	452,414	124,137	1,232	57
VAS2010	2,281,492	3,266,979	171,495	669,909	111,457	1,281	58
VAS2011	3,079,478	5,549,281	171,495	966,628	228,599	2,382	71
YEI2009	3,898,748	6,168,764	224,475	463,993	73,496	2,228	385
YEI2010	4,458,888	5,597,823	224,475	696,492	97,534	3,900	123
YEI2011	5,396,040	6,301,926	224,475	1,083,106	111,550	5,565	35

DEA Results (obtained by EMS Software)

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
ABC2009	0.90	0.33	0.33	0.46	0	0	0	0
ABC2010	0.91	0.33	0.33	0.48	0	0	0	0
ABC2011	1.00	2	1.1	2.02	0	0	0	0
ACE2009	0.82	0.33	0.33	0.5	0.04	0.58	0	0.09
ACE2010	0.87	0.33	0.33	0.59	0.01	0.6	0.11	0.1
ACE2011	0.89	0.33	0.33	0.75	0.19	0.66	0.05	0.05

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
AGP2009	1.00	0.7	1.29	3.57	0.02	0.29	4.67	0.01
AGP2010	1.00	0.33	1.01	3.35	0	0.08	4.24	0
AGP2011	1.00	0.7	0.38	1.6	1.58	0	0.81	0
ALC2009	0.98	0.48	0.33	1.15	0.57	0	1.03	0.01
ALC2010	1.00	0.42	0.73	1.03	0.28	1.6	0.03	0.01
ALC2011	1.00	0.34	0.39	0.79	0.46	0.78	0.01	0.01
BCN2009	0.95	0.33	0.33	0	0	0	0.54	0.13
BCN2010	1.00	0.55	0.34	0.44	0.01	0.01	0.55	0.82
BCN2011	1.00	2.65	0.41	0.43	0.1	1.7	0.82	0.81
BIO2009	0.92	0.33	0.33	0	0.02	0.05	0.61	0
BIO2010	0.93	0.33	0.33	0	0.03	0.04	0.61	0
BIO2011	0.94	0.33	0.33	0	0.04	0.04	0.61	0
BJZ2009	1.00	0.98	1.21	0.09	0.01	0.06	0.17	0
BJZ2010	1.00	1.7	0.49	0.04	0.05	0.02	0.16	0
BJZ2011	1.00	1.68	0.45	0.07	0.01	0.03	0	0
EAS2009	0.72	0.33	0.33	0.09	0.02	0.06	0.05	0
EAS2010	0.74	0.33	0.33	0.1	0.02	0.06	0.04	0
EAS2011	0.75	0.33	0.33	0.11	0.02	0.06	0.05	0
FUE2009	0.73	0.33	0.33	0	0.03	0.15	0.18	0.01
FUE2010	0.80	0.33	0.33	0	0.04	0.18	0.21	0.01
FUE2011	0.82	0.33	0.33	0	0.04	0.2	0.22	0.01
GMZ2009	0.85	0.33	0.33	0.9	0	0	0.14	0
GMZ2010	0.85	0.33	0.33	1.96	0.04	0	0	0
GMZ2011	1.00	1.13	1.19	0.83	0.01	0.01	0.01	0
GRO2009	1.00	1.85	1.46	0.22	0.02	2.51	0.54	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
GRO2010	1.00	0.97	1.9	0.21	0.06	2.46	0.12	0
GRO2011	0.76	0.33	0.33	0.04	0.05	0.21	0.09	0
GRX2009	0.69	0.33	0.33	0.06	0.04	0.09	0.13	0
GRX2010	0.67	0.33	0.33	0.06	0.04	0.08	0.12	0
GRX2011	0.66	0.33	0.33	0.07	0.04	0.07	0.12	0
IBZ2009	0.81	0.33	0.33	0	0.03	0.04	0.48	0
IBZ2010	0.91	0.33	0.33	0.04	0	0.14	0.65	0
IBZ2011	0.87	0.33	0.33	0.06	0	0.13	0.6	0
LCG2009	0.70	0.33	0.33	0.04	0.04	0.08	0.14	0
LCG2010	0.69	0.33	0.33	0.06	0.04	0.03	0.24	0
LCG2011	0.69	0.33	0.33	0.06	0.04	0.03	0.22	0
LEI2009	0.61	0.33	0.33	0.06	0.04	0.05	0.11	0
LEI2010	0.64	0.33	0.33	0.07	0.04	0.06	0.13	0
LEI2011	0.65	0.33	0.33	0.07	0.04	0.06	0.13	0
LEN2009	0.78	0.33	0.33	0.31	0.02	0.04	0.01	0
LEN2010	0.77	0.33	0.33	0.28	0.05	0	0.02	0
LEN2011	0.82	0.33	0.33	0.32	0.05	0	0.02	0
LPA2009	0.95	0.41	0.33	0	0	0	0.79	0.17
LPA2010	1.00	0.36	1.49	0.03	0.02	0.67	1.32	0.27
LPA2011	0.99	0.45	0.33	0	0.02	0	0.85	0.15
MAH2009	0.62	0.33	0.33	0	0.02	0.07	0.17	0.01
MAH2010	0.68	0.33	0.33	0	0.04	0.05	0.27	0.01
MAH2011	0.66	0.33	0.33	0	0.03	0.11	0.14	0.01
MJV2009	0.90	0.33	0.33	0.09	0.09	0.24	0.07	0
MJV2010	0.79	0.33	0.33	0.08	0.06	0.17	0.07	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
MJV2011	0.74	0.33	0.33	0	0.02	0.27	0	0
MLN2009	0.68	0.33	0.33	0.26	0	0.04	0.15	0.01
MLN2010	0.70	0.33	0.33	0.3	0	0.05	0.15	0.01
MLN2011	0.73	0.33	0.33	0.32	0	0.05	0.17	0.01
ODB2009	1.00	0.62	1.35	0.95	0.01	0	0.14	0
ODB2010	0.94	0.33	0.33	0.14	0.03	0	0.01	0
ODB2011	1.00	1.58	1.65	0.87	0.11	0	0	0
OVD2009	0.70	0.33	0.33	0.06	0.05	0.14	0.06	0
OVD2010	0.73	0.33	0.33	0.07	0.05	0.15	0.06	0
OVD2011	0.68	0.33	0.33	0.06	0.04	0.13	0.06	0
PMI2009	0.98	0.38	0.33	2.11	0	0	2.64	0.06
PMI2010	1.00	1.4	1.87	0.81	0.08	2.46	1.36	0.18
PMI2011	1.00	0.65	0.35	0.6	0.12	1.21	0.13	0.06
PNA2009	0.67	0.33	0.33	0.06	0.02	0.04	0.13	0
PNA2010	0.66	0.33	0.33	0.07	0.02	0.03	0.12	0
PNA2011	0.65	0.33	0.33	0.08	0.02	0.03	0.12	0
REU2009	0.81	0.33	0.33	0.08	0	0.05	0.41	0
REU2010	0.86	0.33	0.33	0.1	0	0.05	0.48	0
REU2011	0.75	0.33	0.33	0.1	0	0.05	0.37	0
RGS2009	0.89	0.33	0.33	0.17	0	0	0.01	0
RGS2010	0.85	0.33	0.33	0.15	0	0	0.01	0
RGS2011	1.00	2.13	1.08	1.13	0	0.02	0.39	0
RJL2009	0.78	0.33	0.33	0.16	0.01	0	0.13	0
RJL2010	0.71	0.33	0.33	0.13	0.01	0	0.02	0
RJL2011	0.75	0.33	0.33	0.13	0.01	0	0	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
SCQ2009	0.62	0.33	0.33	0.04	0.04	0.09	0.1	0.01
SCQ2010	0.65	0.33	0.33	0.06	0.05	0.15	0.04	0.01
SCQ2011	0.64	0.33	0.33	0.05	0.05	0.13	0.06	0.01
SDR2009	0.83	0.33	0.33	0.12	0	0.04	0.47	0
SDR2010	0.77	0.33	0.33	0.12	0	0.04	0.42	0
SDR2011	0.84	0.33	0.33	0.06	0	0.18	0.19	0
SLM2009	1.00	3.26	2.04	0.65	0.01	0.01	4.4	0
SLM2010	1.00	1.05	1.62	0.36	0.02	0	1.88	0
SLM2011	1.00	2.51	0.53	0.29	0	0	2.22	0
SPC2009	0.67	0.33	0.33	0.07	0	0.03	0.29	0
SPC2010	0.66	0.33	0.33	0.07	0	0.03	0.3	0
SPC2011	0.67	0.33	0.33	0.07	0	0.04	0.28	0
SVQ2009	0.77	0.33	0.33	0	0.02	0.03	0.44	0
SVQ2010	0.79	0.33	0.33	0	0.05	0.02	0.4	0.01
SVQ2011	0.82	0.33	0.33	0	0.04	0.03	0.47	0
TFN2009	1.00	2.27	0.56	0.48	0.01	0.22	2.21	0.54
TFN2010	1.00	0.79	1.45	0.22	0.01	0.4	1.71	0.24
TFN2011	0.96	0.33	0.33	0.5	0.15	0	0.55	0.21
TFS2009	0.73	0.33	0.33	0.39	0.12	0.44	0	0.07
TFS2010	0.80	0.33	0.33	0.52	0.17	0.54	0	0.07
TFS2011	0.90	0.33	0.33	0.62	0.24	0.67	0	0.05
VDE2009	1.00	0.35	0.35	46.6	0.01	1.16	0.03	0.16
VDE2010	1.00	0.34	1.15	2.8	0.01	0.06	0.05	0.01
VDE2011	1.00	0.42	0.49	1.98	0	0.01	0.07	0
VGO2009	0.69	0.33	0.33	0.05	0.04	0.08	0.13	0.01

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
VGO2010	0.66	0.33	0.33	0.05	0.04	0.08	0.12	0.01
VGO2011	0.59	0.33	0.33	0.05	0.02	0.05	0.11	0.01
VIT2009	0.79	0.33	0.33	0.47	0	0	0.16	0.57
VIT2010	0.80	0.33	0.33	0.38	0	0	0	0.57
VIT2011	1.00	0.58	1.01	1	0.01	0	0	1.92
VLC2009	1.00	1.27	0.34	0.11	0.02	0.01	1.78	0.07
VLC2010	1.00	0.72	0.45	0.13	0.07	0.03	1.22	0.04
VLC2011	0.93	0.33	0.33	0.44	0.21	0.05	0.49	0.11
VLL2009	0.74	0.33	0.33	0.11	0.04	0.06	0.14	0
VLL2010	0.76	0.33	0.33	0.11	0.05	0.07	0.14	0
VLL2011	0.67	0.33	0.33	0.1	0	0.08	0.12	0
XRY2009	0.93	0.33	0.33	1.49	0	0	1.5	0
XRY2010	0.84	0.33	0.33	0.07	0.04	0.01	0.44	0
XRY2011	1.00	1.35	0.84	0.22	0	0.05	2.1	0
ZAZ2009	0.96	0.33	0.33	0	0.08	0	0.14	0.32
ZAZ2010	1.00	0.67	1.16	0.38	0.04	0.09	0.01	1.75
ZAZ2011	1.00	0.77	0.81	0.45	0.03	0.08	0	1.64
ADA2009	0.70	0.33	0.33	0.03	0	0.17	0.12	0.03
ADA2010	0.79	0.33	0.33	0.27	0	0.22	0.21	0.12
ADA2011	0.79	0.33	0.33	0.05	0	0.12	0.31	0.03
ADB2009	0.65	0.33	0.33	0	0	0.15	0.18	0.03
ADB2010	0.92	0.33	1.34	0	0	1.01	0.72	0.21
ADB2011	1.00	0.37	2.14	0	0.01	2.51	0.1	0.26
ADF2009	1.00	2.14	3.38	1.83	0.01	0.34	0.01	0.01
ADF2010	0.98	0.33	1.03	0.35	0	0.16	0	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
ASR2009	0.66	0.33	0.33	0.08	0	0.17	0	0
ASR2010	0.66	0.33	0.33	0.08	0	0.19	0	0
ASR2011	0.67	0.33	0.33	0.07	0	0.22	0	0
AYT2009	0.95	0.33	0.33	0	0.6	0	0	0
AYT2010	1.00	0.92	2.16	0.16	2.57	0.57	0.01	0.01
AYT2011	1.00	2.4	0.34	1.06	1.99	1.55	0.03	0.01
BJV2009	0.68	0.33	0.33	0.04	0.24	0	0.06	0
BJV2010	0.71	0.33	0.33	0.04	0.26	0	0.07	0
BJV2011	0.73	0.33	0.33	0.04	0.29	0	0.06	0
DIY2009	0.82	0.33	0.33	0.17	0	0.31	0	0.01
DIY2010	1.00	0.34	3.39	0.21	0	2.76	0.01	0.06
DIY2011	0.93	0.33	0.33	0	0	0.45	0	0.01
DLM2009	0.70	0.33	0.33	0	0.05	0.27	0	0
DLM2010	0.74	0.33	0.33	0	0.06	0.31	0	0
DLM2011	0.73	0.33	0.33	0	0.06	0.29	0	0
DNZ2009	0.57	0.33	0.33	0.12	0	0.04	0	0
DNZ2011	0.52	0.33	0.33	0.09	0	0.04	0	0
ERC2009	0.65	0.33	0.33	0.17	0	0.05	0	0
ERC2011	0.56	0.33	0.33	0.11	0	0.05	0	0
ERZ2009	0.57	0.33	0.33	0	0	0.13	0	0
ERZ2010	0.61	0.33	0.33	0	0	0.17	0	0
ERZ2011	0.55	0.33	0.33	0	0	0.13	0	0
ESB2009	0.66	0.33	0.33	0	0	0.17	0.18	0.03
ESB2010	0.82	0.33	0.86	0	0	0.61	0.51	0.11
ESB2011	1.00	0.34	3.59	0.01	0	1.55	3.5	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
EZS2009	0.66	0.33	0.33	0	0	0.13	0	0
EZS2010	0.71	0.33	0.33	0.16	0	0.16	0	0
EZS2011	0.70	0.33	0.33	0.14	0	0.17	0	0
GNY2009	0.47	0.33	0.33	0	0	0.03	0	0
GNY2010	0.48	0.33	0.33	0	0	0.04	0	0
GNY2011	0.47	0.33	0.33	0	0	0.04	0	0
GZT2009	0.54	0.33	0.33	0	0	0.12	0	0
GZT2010	0.56	0.33	0.33	0	0	0.15	0	0.01
GZT2011	0.57	0.33	0.33	0	0	0.17	0	0.01
HTY2009	0.74	0.33	0.33	0.16	0	0.13	0	0
HTY2010	0.77	0.33	0.33	0.14	0	0.2	0	0
HTY2011	0.67	0.33	0.33	0.11	0	0.17	0	0
ISE2010	0.59	0.33	0.33	0.11	0	0	0.09	0
KCM2009	0.89	0.33	0.33	0.15	0	0.04	0.01	0
KCM2011	0.74	0.33	0.33	0.18	0	0.05	0	0
KSY2009	0.68	0.33	0.33	0.22	0	0.11	0	0
KSY2010	0.68	0.33	0.33	0.23	0	0.13	0	0
KSY2011	0.65	0.33	0.33	0.19	0	0.12	0	0
KYA2009	0.64	0.33	0.33	0	0	0.12	0	0
KYA2010	0.68	0.33	0.33	0	0	0.18	0	0
KYA2011	0.64	0.33	0.33	0	0	0.17	0	0
MLX2009	0.86	0.33	0.33	0.27	0	0.22	0	0.01
MLX2010	0.78	0.33	0.33	0.22	0	0.2	0	0.01
MLX2011	0.67	0.33	0.33	0	0	0.17	0	0
MQM2009	0.86	0.33	0.33	0.13	0	0.12	0	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
MQM2010	0.76	0.33	0.33	0.2	0	0.14	0	0
MSR2009	0.82	0.33	0.33	0.38	0	0.08	0	0
MSR2010	0.80	0.33	0.33	0.34	0	0.11	0	0
MSR2011	0.77	0.33	0.33	0.33	0	0.11	0	0
MZH2009	0.92	0.33	0.33	0.31	0	0	0	0
MZH2010	0.83	0.33	0.33	0.31	0	0.04	0	0
NAV2009	0.53	0.33	0.33	0.13	0	0.03	0	0
NAV2010	0.54	0.33	0.33	0.13	0	0.04	0	0
NAV2011	0.53	0.33	0.33	0.12	0	0.04	0	0
SZF2009	0.58	0.33	0.33	0.08	0	0.14	0	0
SZF2010	0.58	0.33	0.33	0.08	0	0.15	0	0
SZF2011	0.61	0.33	0.33	0.07	0	0.17	0	0
TEQ2009	0.89	0.33	0.33	0.23	0	0	0.6	0.02
TEQ2010	1.00	2.65	2.67	1.63	0.02	0	5.51	0.44
TEQ2011	1.00	0.34	5.75	1.8	0	0	8.23	0
TZX2009	0.62	0.33	0.33	0.05	0	0.19	0	0.01
TZX2010	0.65	0.33	0.33	0.05	0	0.23	0	0.01
TZX2011	0.66	0.33	0.33	0.04	0	0.24	0	0.02
USQ2011	0.78	0.33	0.33	0.24	0	0	0	0
VAN2009	0.79	0.33	0.33	0.14	0	0.23	0	0.01
VAN2010	0.82	0.33	0.33	0.14	0	0.27	0	0.01
VAN2011	0.80	0.33	0.33	0.12	0	0.27	0	0.02
VAS2009	0.73	0.33	0.33	0.18	0	0.06	0	0
VAS2010	0.60	0.33	0.33	0	0	0.05	0	0
VAS2011	0.54	0.33	0.33	0	0	0.06	0	0

DMU	Score	StaffC {I}{V}	OtherC {I}{V}	Rwy {IN}{V}	TotRev {O}{V}	PAX {ON}{V}	ATM {ON}{V}	Cargo {ON}{V}
YEI2009	0.48	0.33	0.33	0	0	0	0	0
YEI2010	0.47	0.33	0.33	0	0	0.02	0	0
YEI2011	0.47	0.33	0.33	0	0	0.01	0.05	0

DEA Results (obtained by EMS Software) (Cont'd)

DMU	Benchmarks
ABC2009	3 (0.82) 19 (0.17) 30 (0.01)
ABC2010	3 (0.85) 19 (0.14) 30 (0.01)
ABC2011	5
ACE2009	15 (0.02) 30 (0.14) 31 (0.76) 105 (0.03) 111 (0.06)
ACE2010	15 (0.02) 31 (0.74) 68 (0.01) 97 (0.05) 105 (0.16) 111 (0.03)
ACE2011	15 (0.02) 31 (0.64) 68 (0.06) 69 (0.01) 105 (0.27) 136 (0.00)
AGP2009	1
AGP2010	0
AGP2011	1
ALC2009	9 (0.01) 11 (0.72) 12 (0.10) 31 (0.10) 69 (0.04) 105 (0.03)
ALC2010	2
ALC2011	1
BCN2009	15 (0.90) 97 (0.07) 123 (0.02)
BCN2010	0
BCN2011	7
BIO2009	31 (0.14) 98 (0.26) 120 (0.54) 136 (0.06)

DMU	Benchmarks
BIO2010	31 (0.21) 98 (0.23) 120 (0.50) 136 (0.06)
BIO2011	31 (0.24) 98 (0.22) 120 (0.48) 136 (0.06)
BJZ2009	111
BJZ2010	3
BJZ2011	0
EAS2009	19 (0.13) 30 (0.05) 32 (0.06) 61 (0.76) 123 (0.00) 136 (0.00)
EAS2010	19 (0.14) 30 (0.04) 32 (0.05) 61 (0.78) 123 (0.00) 136 (0.00)
EAS2011	19 (0.13) 30 (0.00) 32 (0.04) 61 (0.82) 123 (0.00) 136 (0.00)
FUE2009	19 (0.09) 31 (0.61) 88 (0.25) 123 (0.03) 136 (0.02)
FUE2010	19 (0.08) 31 (0.68) 88 (0.19) 123 (0.03) 136 (0.03)
FUE2011	19 (0.08) 31 (0.77) 88 (0.09) 123 (0.02) 136 (0.04)
GMZ2009	30 (0.96) 61 (0.01) 105 (0.02)
GMZ2010	30 (1.00) 105 (0.00) 111 (0.00) 136 (0.00)
GMZ2011	61
GRO2009	36
GRO2010	100
GRO2011	19 (0.09) 30 (0.06) 32 (0.59) 78 (0.25) 136 (0.01)
GRX2009	19 (0.30) 32 (0.23) 61 (0.20) 89 (0.27) 123 (0.00) 136 (0.00)
GRX2010	19 (0.41) 32 (0.17) 61 (0.25) 89 (0.16) 136 (0.00)
GRX2011	19 (0.41) 32 (0.16) 61 (0.26) 89 (0.17) 136 (0.00)
IBZ2009	31 (0.52) 98 (0.39) 120 (0.08) 136 (0.01)
IBZ2010	31 (0.57) 98 (0.28) 113 (0.14) 136 (0.01)
IBZ2011	31 (0.63) 68 (0.03) 113 (0.34) 136 (0.00)
LCG2009	19 (0.03) 32 (0.18) 61 (0.67) 89 (0.11) 123 (0.00) 136 (0.01)
LCG2010	31 (0.16) 61 (0.66) 88 (0.15) 98 (0.01) 123 (0.00) 136 (0.01)

DMU	Benchmarks
LCG2011	31 (0.06) 32 (0.09) 61 (0.69) 88 (0.15) 123 (0.00) 136 (0.01)
LEI2009	19 (0.14) 32 (0.09) 61 (0.11) 89 (0.64) 136 (0.01)
LEI2010	19 (0.06) 32 (0.10) 61 (0.09) 89 (0.74) 136 (0.01)
LEI2011	19 (0.19) 32 (0.11) 61 (0.10) 89 (0.59) 136 (0.01)
LEN2009	19 (0.65) 32 (0.00) 61 (0.22) 130 (0.12) 136 (0.00)
LEN2010	19 (0.68) 30 (0.12) 61 (0.20) 136 (0.00)
LEN2011	19 (0.69) 30 (0.15) 61 (0.16) 136 (0.00)
LPA2009	50 (0.55) 68 (0.21) 97 (0.09) 123 (0.15)
LPA2010	4
LPA2011	50 (0.62) 68 (0.23) 97 (0.08) 123 (0.06) 136 (0.01)
MAH2009	31 (0.24) 32 (0.21) 88 (0.49) 122 (0.06) 136 (0.00)
MAH2010	32 (0.49) 88 (0.45) 98 (0.01) 122 (0.05) 136 (0.00)
MAH2011	19 (0.04) 32 (0.46) 89 (0.45) 122 (0.05) 136 (0.01)
MJV2009	19 (0.30) 30 (0.37) 32 (0.30) 61 (0.02) 136 (0.01)
MJV2010	19 (0.33) 30 (0.41) 32 (0.24) 61 (0.02) 136 (0.01)
MJV2011	19 (0.78) 32 (0.22) 136 (0.01)
MLN2009	30 (0.24) 31 (0.04) 61 (0.70) 98 (0.01) 123 (0.00)
MLN2010	30 (0.26) 31 (0.05) 61 (0.69) 98 (0.00) 123 (0.01)
MLN2011	30 (0.23) 31 (0.05) 61 (0.72) 98 (0.00) 123 (0.00)
ODB2009	57
ODB2010	19 (0.00) 30 (0.05) 63 (0.95) 136 (0.00)
ODB2011	1
OVD2009	19 (0.22) 30 (0.08) 32 (0.22) 61 (0.46) 123 (0.00) 136 (0.01)
OVD2010	19 (0.22) 30 (0.05) 32 (0.23) 61 (0.49) 123 (0.00) 136 (0.01)
OVD2011	19 (0.24) 30 (0.19) 32 (0.23) 61 (0.33) 123 (0.00) 136 (0.01)

DMU	Benchmarks
PMI2009	7 (0.00) 15 (0.01) 68 (0.47) 69 (0.51) 112 (0.01)
PMI2010	7
PMI2011	3
PNA2009	19 (0.06) 32 (0.06) 61 (0.57) 89 (0.31) 122 (0.00) 136 (0.00)
PNA2010	19 (0.19) 32 (0.05) 61 (0.51) 89 (0.25) 122 (0.00) 136 (0.00)
PNA2011	19 (0.24) 32 (0.04) 61 (0.52) 89 (0.20) 122 (0.00) 136 (0.00)
REU2009	31 (0.25) 61 (0.15) 88 (0.26) 120 (0.34)
REU2010	31 (0.21) 61 (0.23) 88 (0.32) 98 (0.01) 120 (0.23)
REU2011	31 (0.24) 61 (0.31) 88 (0.40) 98 (0.00) 120 (0.05)
RGS2009	3 (0.06) 19 (0.01) 30 (0.10) 78 (0.83)
RGS2010	3 (0.02) 19 (0.08) 30 (0.15) 78 (0.76) 123 (0.00)
RGS2011	9
RJL2009	61 (0.04) 78 (0.87) 89 (0.10) 136 (0.00)
RJL2010	20 (0.13) 30 (0.12) 78 (0.75) 136 (0.00)
RJL2011	20 (0.12) 30 (0.10) 78 (0.77)
SCQ2009	19 (0.42) 32 (0.32) 61 (0.13) 89 (0.08) 123 (0.04) 136 (0.01)
SCQ2010	19 (0.46) 30 (0.00) 32 (0.36) 61 (0.13) 123 (0.04) 136 (0.02)
SCQ2011	19 (0.45) 30 (0.12) 32 (0.35) 61 (0.02) 123 (0.03) 136 (0.03)
SDR2009	32 (0.18) 61 (0.40) 88 (0.35) 120 (0.08)
SDR2010	32 (0.18) 61 (0.43) 88 (0.38) 120 (0.00)
SDR2011	19 (0.07) 32 (0.22) 61 (0.43) 89 (0.27)
SLM2009	19
SLM2010	24
SLM2011	0
SPC2009	31 (0.14) 61 (0.50) 88 (0.27) 98 (0.07) 120 (0.03)

DMU	Benchmarks
SPC2010	31 (0.13) 61 (0.50) 88 (0.28) 98 (0.06) 120 (0.03)
SPC2011	31 (0.15) 61 (0.49) 88 (0.28) 98 (0.05) 120 (0.03)
SVQ2009	31 (0.20) 98 (0.34) 120 (0.41) 136 (0.05)
SVQ2010	31 (0.29) 88 (0.02) 98 (0.31) 120 (0.33) 136 (0.05)
SVQ2011	31 (0.46) 98 (0.30) 120 (0.19) 136 (0.05)
TFN2009	5
TFN2010	27
TFN2011	30 (0.01) 97 (0.18) 98 (0.73) 113 (0.08) 136 (0.00)
TFS2009	15 (0.03) 31 (0.83) 105 (0.03) 111 (0.04) 136 (0.07)
TFS2010	15 (0.03) 31 (0.88) 105 (0.01) 111 (0.01) 136 (0.07)
TFS2011	11 (0.40) 31 (0.02) 68 (0.14) 105 (0.36) 136 (0.08)
VDE2009	0
VDE2010	0
VDE2011	11
VGO2009	19 (0.18) 32 (0.17) 61 (0.50) 89 (0.12) 123 (0.01) 136 (0.01)
VGO2010	19 (0.25) 32 (0.17) 61 (0.51) 89 (0.03) 123 (0.02) 136 (0.01)
VGO2011	31 (0.14) 61 (0.19) 78 (0.45) 88 (0.19) 123 (0.02) 136 (0.01)
VIT2009	61 (0.28) 98 (0.02) 111 (0.53) 123 (0.18)
VIT2010	30 (0.28) 111 (0.50) 123 (0.22)
VIT2011	8
VLC2009	1
VLC2010	5
VLC2011	30 (0.08) 31 (0.01) 98 (0.11) 105 (0.02) 113 (0.73) 136 (0.04)
VLL2009	19 (0.48) 32 (0.06) 61 (0.26) 89 (0.19) 122 (0.00) 136 (0.00)
VLL2010	19 (0.53) 32 (0.06) 61 (0.27) 89 (0.13) 122 (0.00) 136 (0.00)

DMU	Benchmarks
VLL2011	19 (0.57) 32 (0.08) 61 (0.27) 89 (0.08) 123 (0.00)
XRY2009	105 (0.08) 113 (0.12) 120 (0.80)
XRY2010	31 (0.03) 61 (0.19) 88 (0.11) 98 (0.00) 120 (0.66) 136 (0.01)
XRY2011	18
ZAZ2009	19 (0.01) 89 (0.12) 122 (0.87) 136 (0.00)
ZAZ2010	22
ZAZ2011	77
ADA2009	19 (0.03) 32 (0.49) 61 (0.30) 89 (0.05) 122 (0.13)
ADA2010	32 (0.50) 61 (0.26) 98 (0.07) 111 (0.04) 123 (0.12)
ADA2011	32 (0.55) 61 (0.17) 89 (0.06) 98 (0.13) 122 (0.08)
ADB2009	31 (0.55) 98 (0.12) 123 (0.22) 136 (0.12)
ADB2010	32 (0.21) 50 (0.08) 122 (0.17) 129 (0.46) 136 (0.08)
ADB2011	2
ADF2009	13
ADF2010	19 (0.03) 32 (0.01) 61 (0.25) 122 (0.00) 130 (0.71)
ASR2009	19 (0.48) 31 (0.12) 78 (0.39) 123 (0.00) 136 (0.00)
ASR2010	19 (0.61) 30 (0.20) 32 (0.18) 123 (0.01)
ASR2011	19 (0.58) 30 (0.17) 32 (0.24) 123 (0.01)
AYT2009	20 (0.13) 136 (0.87)
AYT2010	76
AYT2011	0
BJV2009	30 (0.14) 78 (0.71) 136 (0.14)
BJV2010	19 (0.21) 30 (0.42) 61 (0.22) 136 (0.15)
BJV2011	19 (0.16) 30 (0.51) 61 (0.16) 136 (0.17)
DIY2009	19 (0.77) 30 (0.01) 32 (0.20) 123 (0.02)

DMU	Benchmarks
DIY2010	0
DIY2011	19 (0.64) 32 (0.34) 123 (0.02)
DLM2009	19 (0.59) 32 (0.33) 136 (0.08)
DLM2010	19 (0.38) 32 (0.58) 136 (0.04)
DLM2011	19 (0.40) 32 (0.56) 136 (0.05)
DNZ2009	19 (0.70) 30 (0.28) 32 (0.02)
DNZ2011	19 (0.70) 30 (0.28) 32 (0.02) 123 (0.00)
ERC2009	19 (0.71) 30 (0.28) 32 (0.01) 123 (0.00)
ERC2011	19 (0.70) 30 (0.27) 32 (0.03) 123 (0.00)
ERZ2009	19 (0.89) 32 (0.11) 123 (0.00)
ERZ2010	19 (0.86) 32 (0.14) 122 (0.00)
ERZ2011	19 (0.84) 32 (0.15) 123 (0.01)
ESB2009	32 (0.27) 98 (0.53) 123 (0.08) 136 (0.12)
ESB2010	32 (0.27) 50 (0.35) 98 (0.01) 122 (0.01) 129 (0.37)
ESB2011	0
EZS2009	19 (0.94) 32 (0.06) 122 (0.00)
EZS2010	19 (0.59) 32 (0.08) 122 (0.00) 130 (0.33)
EZS2011	19 (0.58) 32 (0.10) 122 (0.00) 130 (0.32)
GNY2009	19 (1.00) 136 (0.00)
GNY2010	19 (0.99) 123 (0.00) 136 (0.01)
GNY2011	19 (0.99) 123 (0.00) 136 (0.01)
GZT2009	19 (0.83) 32 (0.16) 123 (0.02)
GZT2010	19 (0.78) 32 (0.20) 123 (0.02)
GZT2011	19 (0.72) 32 (0.26) 123 (0.02)
HTY2009	19 (0.69) 30 (0.26) 32 (0.05) 123 (0.00)

DMU	Benchmarks
HTY2010	19 (0.65) 30 (0.24) 32 (0.11) 123 (0.00)
HTY2011	19 (0.65) 30 (0.22) 32 (0.13) 123 (0.00)
ISE2010	19 (0.62) 61 (0.32) 89 (0.06) 122 (0.00)
KCM2009	19 (0.00) 30 (0.21) 32 (0.00) 130 (0.79)
KCM2011	19 (0.29) 32 (0.00) 123 (0.00) 130 (0.70)
KSY2009	19 (0.87) 30 (0.09) 32 (0.05) 123 (0.00)
KSY2010	19 (0.84) 32 (0.05) 123 (0.00) 130 (0.11)
KSY2011	19 (0.86) 30 (0.08) 32 (0.06) 123 (0.00)
KYA2009	19 (0.95) 32 (0.05)
KYA2010	19 (0.90) 32 (0.10) 122 (0.00)
KYA2011	19 (0.89) 32 (0.11) 122 (0.00)
MLX2009	19 (0.74) 32 (0.08) 123 (0.01) 130 (0.17)
MLX2010	19 (0.74) 32 (0.09) 123 (0.01) 130 (0.16)
MLX2011	19 (0.89) 32 (0.10) 123 (0.01)
MQM2009	19 (0.34) 30 (0.62) 32 (0.04)
MQM2010	19 (0.80) 30 (0.15) 32 (0.05) 123 (0.00)
MSR2009	19 (0.90) 30 (0.09) 32 (0.01) 123 (0.00)
MSR2010	19 (0.90) 30 (0.08) 32 (0.02) 123 (0.00)
MSR2011	19 (0.89) 30 (0.08) 32 (0.03) 123 (0.00)
MZH2009	3 (0.35) 19 (0.36) 30 (0.29) 123 (0.00)
MZH2010	19 (0.69) 30 (0.31) 32 (0.00) 123 (0.00)
NAV2009	19 (0.62) 32 (0.01) 123 (0.00) 130 (0.37)
NAV2010	19 (0.62) 32 (0.01) 130 (0.37)
NAV2011	19 (0.62) 32 (0.02) 130 (0.36)
SZF2009	19 (0.63) 30 (0.20) 32 (0.17) 123 (0.00)

DMU	Benchmarks
SZF2010	19 (0.62) 30 (0.19) 32 (0.19)
SZF2011	19 (0.59) 30 (0.18) 32 (0.23) 123 (0.01)
TEQ2009	61 (0.07) 88 (0.47) 120 (0.07) 195 (0.39)
TEQ2010	1
TEQ2011	0
TZX2009	19 (0.37) 30 (0.29) 32 (0.32) 123 (0.03)
TZX2010	19 (0.31) 30 (0.26) 32 (0.39) 123 (0.04)
TZX2011	19 (0.24) 30 (0.25) 32 (0.45) 123 (0.06)
USQ2011	19 (0.49) 61 (0.51)
VAN2009	19 (0.53) 30 (0.32) 32 (0.14) 123 (0.01)
VAN2010	19 (0.51) 30 (0.31) 32 (0.17) 123 (0.02)
VAN2011	19 (0.38) 32 (0.20) 123 (0.03) 130 (0.40)
VAS2009	19 (0.54) 30 (0.44) 32 (0.01) 123 (0.00)
VAS2010	19 (0.99) 32 (0.01) 123 (0.00)
VAS2011	19 (0.97) 32 (0.03) 123 (0.00)
YEI2009	19 (0.99) 123 (0.01)
YEI2010	19 (0.99) 32 (0.00) 123 (0.00)
YEI2011	19 (0.82) 32 (0.01) 89 (0.17) 122 (0.00) 136 (0.00)

DEA Results (obtained by EMS Software) (Cont'd)

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
ABC2009	85%	86%	100%	57108	4685	0	0
ABC2010	82%	91%	100%	1	6805	104	0
ABC2011							
ACE2009	80%	67%	100%	0	0	413	0
ACE2010	82%	77%	100%	68	0	0	0
ACE2011	87%	80%	100%	0	0	0	0
AGP2009							
AGP2010							
AGP2011							
ALC2009	100%	93%	100%	0	160744	0	0
ALC2010							
ALC2011							
BCN2009	89%	96%	94%	82932716	4008363	0	0
BCN2010							
BCN2011							
BIO2009	94%	82%	65%	0	0	0	2067
BIO2010	89%	91%	65%	0	0	0	1646
BIO2011	90%	92%	65%	0	0	0	1421
BJZ2009							
BJZ2010							
BJZ2011							
EAS2009	64%	51%	100%	0	0	0	0
EAS2010	64%	56%	100%	0	0	0	0

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
EAS2011	70%	56%	100%	0	0	0	0
FUE2009	67%	52%	55%	0	0	0	0
FUE2010	74%	67%	54%	0	0	0	0
FUE2011	81%	66%	54%	1	0	0	0
GMZ2009	93%	62%	100%	45602	1355	0	0
GMZ2010	84%	72%	100%	0	909	1	0
GMZ2011							
GRO2009							
GRO2010							
GRO2011	68%	61%	100%	0	0	0	26
GRX2009	56%	50%	100%	0	0	0	0
GRX2010	49%	50%	100%	0	0	0	13
GRX2011	50%	48%	100%	0	0	0	2
IBZ2009	73%	69%	98%	1	0	0	3237
IBZ2010	77%	94%	100%	4471286	0	0	3239
IBZ2011	82%	80%	100%	2871155	0	0	1611
LCG2009	64%	47%	100%	0	0	0	0
LCG2010	60%	46%	100%	0	0	0	0
LCG2011	60%	46%	100%	0	0	0	0
LEI2009	42%	42%	100%	0	0	0	109
LEI2010	47%	46%	100%	0	0	0	107
LEI2011	51%	44%	100%	0	0	0	79
LEN2009	61%	73%	100%	0	0	0	6
LEN2010	57%	75%	100%	0	3781	0	13
LEN2011	62%	84%	100%	0	6133	0	7

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
LPA2009	100%	86%	97%	6431881	1073302	0	0
LPA2010							
LPA2011	100%	97%	98%	0	819011	0	0
MAH2009	45%	41%	68%	0	0	0	0
MAH2010	48%	58%	66%	0	0	0	0
MAH2011	48%	49%	68%	0	0	0	0
MJV2009	73%	97%	100%	0	0	0	61
MJV2010	62%	75%	100%	0	0	0	78
MJV2011	57%	65%	91%	0	0	629	72
MLN2009	64%	41%	100%	808036	0	0	0
MLN2010	64%	46%	100%	995914	0	0	0
MLN2011	70%	48%	100%	1003903	0	0	0
ODB2009							
ODB2010	89%	91%	100%	0	15529	0	6
ODB2011							
OVD2009	53%	57%	100%	0	0	0	0
OVD2010	57%	62%	100%	0	0	0	0
OVD2011	52%	53%	100%	0	0	0	0
PMI2009	100%	93%	100%	15343105	675775	0	0
PMI2010							
PMI2011							
PNA2009	56%	45%	100%	0	0	0	0
PNA2010	52%	46%	100%	0	0	0	0
PNA2011	53%	42%	100%	0	0	0	0
REU2009	81%	62%	100%	1395328	0	0	26

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
REU2010	77%	80%	100%	718397	0	0	0
REU2011	66%	59%	100%	590992	0	0	0
RGS2009	82%	86%	100%	2	6300	0	1
RGS2010	79%	77%	100%	0	3863	0	0
RGS2011							
RJL2009	69%	66%	100%	0	14066	0	6
RJL2010	59%	55%	100%	0	15227	0	1
RJL2011	71%	54%	100%	0	20500	937	1
SCQ2009	43%	42%	100%	0	0	0	0
SCQ2010	41%	53%	100%	0	0	0	0
SCQ2011	43%	48%	100%	0	0	0	0
SDR2009	69%	79%	100%	465089	0	0	4
SDR2010	66%	65%	100%	273644	0	0	10
SDR2011	71%	81%	100%	895957	0	0	13
SLM2009							
SLM2010							
SLM2011							
SPC2009	55%	46%	100%	1343255	0	0	0
SPC2010	52%	47%	100%	617289	0	0	0
SPC2011	61%	40%	100%	1022343	0	0	0
SVQ2009	65%	65%	90%	1	0	0	947
SVQ2010	63%	74%	89%	0	0	0	0
SVQ2011	66%	79%	89%	24	1	0	90
TFN2009							
TFN2010							

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
TFN2011	98%	89%	100%	0	43242	0	0
TFS2009	52%	67%	100%	0	0	11321	0
TFS2010	51%	89%	100%	0	0	11218	0
TFS2011	75%	95%	100%	0	0	10952	0
VDE2009							
VDE2010							
VDE2011							
VGO2009	60%	48%	100%	0	0	0	0
VGO2010	55%	44%	100%	0	0	0	0
VGO2011	46%	32%	100%	0	0	0	0
VIT2009	70%	67%	100%	404687	176683	0	0
VIT2010	64%	76%	100%	179944	143686	155	0
VIT2011							
VLC2009							
VLC2010							
VLC2011	88%	92%	100%	0	0	0	0
VLL2009	52%	71%	100%	0	0	0	0
VLL2010	51%	77%	100%	0	0	0	0
VLL2011	56%	46%	100%	471419	0	0	0
XRY2009	95%	84%	100%	3731766	370711	0	1352
XRY2010	78%	73%	100%	0	0	0	0
XRY2011							
ZAZ2009	88%	99%	94%	0	33768	0	0
ZAZ2010							
ZAZ2011							

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
ADA2009	43%	66%	100%	4175962	0	0	0
ADA2010	46%	91%	100%	5822891	0	0	0
ADA2011	43%	95%	100%	5568153	0	0	0
ADB2009	39%	58%	67%	27541867	0	0	0
ADB2010	76%	100%	91%	22461330	0	0	0
ADB2011							
ADF2009							
ADF2010	94%	100%	100%	182470	0	2170	0
ASR2009	61%	37%	100%	1545	0	2570	0
ASR2010	61%	37%	100%	885567	0	2003	0
ASR2011	59%	43%	100%	1917653	0	1997	0
AYT2009	97%	89%	92%	0	729765	2126	852
AYT2010							
AYT2011							
BJV2009	41%	64%	100%	0	262535	0	981
BJV2010	45%	69%	100%	0	257677	0	1204
BJV2011	42%	78%	100%	0	353633	0	1379
DIY2009	66%	81%	100%	4732453	0	3048	0
DIY2010							
DIY2011	80%	98%	95%	8859396	0	3601	0
DLM2009	39%	71%	63%	1	0	4035	196
DLM2010	44%	79%	54%	0	0	5819	224
DLM2011	39%	81%	55%	0	0	4455	239
DNZ2009	42%	29%	100%	529000	0	2170	3
DNZ2011	32%	24%	100%	680918	0	1849	0

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
ERC2009	52%	44%	100%	740693	0	2077	0
ERC2011	39%	29%	100%	1152370	0	1932	0
ERZ2009	33%	39%	57%	2130161	0	2875	0
ERZ2010	32%	52%	57%	3071975	0	2648	0
ERZ2011	27%	38%	57%	2768256	0	1964	0
ESB2009	26%	71%	46%	36962702	0	0	0
ESB2010	45%	100%	60%	30824632	0	0	0
ESB2011							
EZS2009	36%	61%	73%	2302916	0	3473	0
EZS2010	41%	72%	100%	2620554	0	1819	0
EZS2011	37%	73%	100%	2497750	0	2186	0
GNY2009	29%	14%	96%	1881897	0	2569	16
GNY2010	29%	15%	96%	2295409	0	2102	0
GNY2011	26%	16%	96%	2387354	0	2341	0
GZT2009	31%	31%	70%	1505824	0	1916	0
GZT2010	32%	34%	69%	2185800	0	1372	0
GZT2011	33%	40%	67%	2530509	0	964	0
HTY2009	75%	47%	100%	1760721	0	2313	0
HTY2010	76%	54%	100%	2471146	0	1944	0
HTY2011	56%	45%	100%	1328609	0	2141	0
ISE2010	48%	30%	100%	122299	20931	0	0
KCM2009	73%	93%	100%	253306	0	0	15
KCM2011	53%	69%	100%	208763	0	365	0
KSY2009	50%	53%	100%	1717321	0	3120	0
KSY2010	47%	57%	100%	1793966	0	2786	0

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
KSY2011	41%	53%	100%	2081626	0	3173	0
KYA2009	39%	54%	56%	1171183	0	1601	3
KYA2010	41%	65%	55%	2766526	0	1270	0
KYA2011	33%	60%	55%	2088455	0	1609	0
MLX2009	69%	88%	100%	2047281	0	1925	0
MLX2010	55%	77%	100%	2197821	0	1033	0
MLX2011	45%	55%	55%	2385107	0	949	0
MQM2009	96%	64%	100%	1811077	0	1951	7
MQM2010	82%	46%	100%	1862489	0	2612	0
MSR2009	79%	67%	100%	614172	0	2864	0
MSR2010	71%	68%	100%	1035963	0	2753	0
MSR2011	60%	70%	100%	1069079	0	2851	0
MZH2009	95%	82%	100%	362528	0	1785	0
MZH2010	69%	79%	100%	440737	0	2520	0
NAV2009	29%	31%	100%	560669	0	1547	0
NAV2010	27%	35%	100%	340096	0	1449	19
NAV2011	25%	34%	100%	341073	0	1357	11
SZF2009	33%	40%	100%	2388991	0	2121	0
SZF2010	33%	41%	100%	2555827	0	1422	13
SZF2011	35%	46%	100%	3737089	0	1796	0
TEQ2009	94%	72%	100%	1141360	86908	0	0
TEQ2010							
TEQ2011							
TZX2009	44%	43%	100%	2421421	0	1043	0
TZX2010	47%	50%	100%	5511682	0	1234	0

DMU	{F} StaffC {I}	{F} OtherC {I}	{F} Rwy {IN}	{S} TotRev {O}	{S} PAX {ON}	{S} ATM {ON}	{S} Cargo {ON}
TZX2011	45%	54%	100%	6765570	0	2157	0
USQ2011	63%	71%	100%	428622	29371	5573	0
VAN2009	63%	75%	100%	4315208	0	2094	0
VAN2010	60%	87%	100%	4648367	0	2129	0
VAN2011	59%	79%	100%	5091698	0	497	0
VAS2009	57%	62%	100%	805883	0	2218	0
VAS2010	43%	36%	100%	342498	0	2803	0
VAS2011	37%	26%	99%	1064214	0	2669	0
YEI2009	24%	18%	77%	294083	7203	1620	0
YEI2010	22%	20%	76%	197503	0	73	0
YEI2011	21%	20%	75%	0	0	0	0

Scale Efficiency and Returns to Scale at Spanish and Turkish Airports, 2011

COUNTRY	AIRPORT	IATA	YEAR	DMU	DEA Score-VRS	DEA Score-CRS	DEA Score-NIRS	SCALE	Returns to Scale
Spain	Albacete	ABC	2011	ABC2011	1.000	0.419	0.419	0.419	irs
Spain	Lanzarote	ACE	2011	ACE2011	0.889	0.841	0.841	0.946	irs
Spain	Málaga	AGP	2011	AGP2011	1.000	1.000	1.000	1.000	CRS
Spain	Alicante	ALC	2011	ALC2011	1.000	1.000	1.000	1.000	CRS
Spain	Barcelona	BCN	2011	BCN2011	1.000	1.000	1.000	1.000	CRS
Spain	Bilbao	BIO	2011	BIO2011	0.939	0.926	0.939	0.986	drs
Spain	Badajoz	BJZ	2011	BJZ2011	1.000	0.591	0.591	0.591	irs
Spain	San Sebastián	EAS	2011	EAS2011	0.753	0.655	0.655	0.870	irs

COUNTRY	AIRPORT	IATA	YEAR	DMU	DEA Score-VRS	DEA Score-CRS	DEA Score-NIRS	SCALE	Returns to Scale
Spain	Fuerteventura	FUE	2011	FUE2011	0.824	0.822	0.822	0.998	irs
Spain	La Gomera	GMZ	2011	GMZ2011	1.000	0.451	0.451	0.451	irs
Spain	Girona	GRO	2011	GRO2011	0.765	0.738	0.738	0.965	irs
Spain	Granada	GRX	2011	GRX2011	0.662	0.621	0.621	0.939	irs
Spain	Ibiza	IBZ	2011	IBZ2011	0.873	0.871	0.873	0.998	drs
Spain	A Coruña	LCG	2011	LCG2011	0.688	0.650	0.650	0.944	irs
Spain	Almería	LEI	2011	LEI2011	0.647	0.630	0.630	0.973	irs
Spain	León	LEN	2011	LEN2011	0.819	0.585	0.585	0.715	irs
Spain	Gran Canaria	LPA	2011	LPA2011	0.991	0.914	0.991	0.923	drs
Spain	Menorca	MAH	2011	MAH2011	0.658	0.657	0.657	0.998	irs
Spain	Murcia - San Javier	MJV	2011	MJV2011	0.740	0.684	0.684	0.923	irs
Spain	Melilla	MLN	2011	MLN2011	0.727	0.603	0.603	0.830	irs
Spain	Córdoba	ODB	2011	ODB2011	1.000	0.782	0.782	0.782	irs
Spain	Asturias	OVD	2011	OVD2011	0.683	0.628	0.628	0.919	irs
Spain	Palma de Mallorca	PMI	2011	PMI2011	1.000	1.000	1.000	1.000	CRS
Spain	Pamplona	PNA	2011	PNA2011	0.651	0.581	0.581	0.893	irs
Spain	Reus	REU	2011	REU2011	0.752	0.736	0.736	0.979	irs
Spain	Burgos	RGS	2011	RGS2011	1.000	0.631	0.631	0.631	irs
Spain	Logroño	RJL	2011	RJL2011	0.751	0.469	0.469	0.624	irs
Spain	Santiago	SCQ	2011	SCQ2011	0.638	0.616	0.616	0.965	irs
Spain	Santander	SDR	2011	SDR2011	0.841	0.804	0.804	0.956	irs
Spain	Salamanca	SLM	2011	SLM2011	1.000	0.971	0.971	0.971	irs
Spain	La Palma	SPC	2011	SPC2011	0.671	0.646	0.646	0.963	irs
Spain	Sevilla	SVQ	2011	SVQ2011	0.815	0.813	0.815	0.997	drs

COUNTRY	AIRPORT	IATA	YEAR	DMU	DEA Score-VRS	DEA Score-CRS	DEA Score-NIRS	SCALE	Returns to Scale
Spain	Tenerife-Norte	TFN	2011	TFN2011	0.958	0.955	0.955	0.997	irs
Spain	Tenerife-Sur	TFS	2011	TFS2011	0.897	0.814	0.814	0.908	irs
Spain	Hierro	VDE	2011	VDE2011	1.000	0.524	0.524	0.524	irs
Spain	Vigo	VGO	2011	VGO2011	0.592	0.553	0.553	0.934	irs
Spain	Vitoria	VIT	2011	VIT2011	1.000	1.000	1.000	1.000	CRS
Spain	Valencia	VLC	2011	VLC2011	0.932	0.924	0.924	0.991	irs
Spain	Valladolid	VLL	2011	VLL2011	0.672	0.601	0.601	0.894	irs
Spain	Jerez de la Frontera	XRY	2011	XRY2011	1.000	1.000	1.000	1.000	CRS
Spain	Zaragoza	ZAZ	2011	ZAZ2011	1.000	1.000	1.000	1.000	CRS
Turkey	Adana	ADA	2011	ADA2011	0.795	0.790	0.790	0.995	irs
Turkey	Izmir-Adnan Menderes	ADB	2011	ADB2011	1.000	0.811	1.000	0.811	drs
Turkey	Kayseri	ASR	2011	ASR2011	0.671	0.585	0.585	0.872	irs
Turkey	Antalya	AYT	2011	AYT2011	1.000	1.000	1.000	1.000	CRS
Turkey	Mugla-Milas Bodrum	BJV	2011	BJV2011	0.733	0.691	0.691	0.942	irs
Turkey	Diyarbakir	DIY	2011	DIY2011	0.929	0.845	0.845	0.910	irs
Turkey	Mugla-Dalaman	DLM	2011	DLM2011	0.732	0.714	0.714	0.976	irs
Turkey	Denizli-Cardak	DNZ	2011	DNZ2011	0.520	0.393	0.393	0.755	irs
Turkey	Erzincan	ERC	2011	ERC2011	0.562	0.410	0.410	0.729	irs
Turkey	Erzurum	ERZ	2011	ERZ2011	0.549	0.489	0.489	0.891	irs
Turkey	Ankara-Esenboga	ESB	2011	ESB2011	1.000	0.716	1.000	0.716	drs
Turkey	Elazig	EZS	2011	EZS2011	0.700	0.530	0.530	0.758	irs
Turkey	Sanliurfa-GAP	GNY	2011	GNY2011	0.472	0.386	0.386	0.817	irs
Turkey	Gaziantep	GZT	2011	GZT2011	0.575	0.541	0.541	0.941	irs

COUNTRY	AIRPORT	IATA	YEAR	DMU	DEA Score-VRS	DEA Score-CRS	DEA Score-NIRS	SCALE	Returns to Scale
Turkey	Hatay	HTY	2011	HTY2011	0.672	0.534	0.534	0.795	irs
Turkey	Kahramanmaras	KCM	2011	KCM2011	0.738	0.410	0.410	0.555	irs
Turkey	Kars	KSY	2011	KSY2011	0.646	0.476	0.476	0.737	irs
Turkey	Konya	KYA	2011	KYA2011	0.644	0.547	0.547	0.849	irs
Turkey	Malatya	MLX	2011	MLX2011	0.666	0.574	0.574	0.861	irs
Turkey	Mus	MSR	2011	MSR2011	0.768	0.465	0.465	0.605	irs
Turkey	Nevsehir-Kapadokya	NAV	2011	NAV2011	0.533	0.390	0.390	0.732	irs
Turkey	Samsun-Carsamba	SZF	2011	SZF2011	0.605	0.537	0.537	0.887	irs
Turkey	Tekirdag-Corlu	TEQ	2011	TEQ2011	1.000	0.978	1.000	0.978	drs
Turkey	Trabzon	TZX	2011	TZX2011	0.664	0.624	0.624	0.941	irs
Turkey	Usak	USQ	2011	USQ2011	0.781	0.368	0.368	0.471	irs
Turkey	Van-Ferit Melen	VAN	2011	VAN2011	0.795	0.672	0.672	0.845	irs
Turkey	Sivas-Nuri Demirag	VAS	2011	VAS2011	0.542	0.411	0.411	0.759	irs
Turkey	Bursa-Yenisehir	YEI	2011	YEI2011	0.470	0.428	0.428	0.912	irs

Dependent and independent variables used for the second stage OLS regression

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
ABC2009	0.90	38.5	0	0.19	0.23	15127	26.6	0.188	1
ABC2010	0.91	38.5	0	0.35	0.14	11293	26.6	0.180	1
ABC2011	1.00	38.5	0	0.31	0.17	8415	26.6	0.384	1
ACE2009	0.82	126.0	0	0.39	0.61	4702084	162.4	0.066	1
ACE2010	0.87	126.0	0	0.39	0.61	4938722	162.5	0.072	1
ACE2011	0.89	126.0	0	0.34	0.64	5544031	162.5	0.068	1
AGP2009	1.00	168.0	0	0.39	0.81	11622770	216.4	0.182	1
AGP2010	1.00	168.0	0	0.38	0.79	12064827	219.0	0.208	1
AGP2011	1.00	168.0	0	0.33	0.79	12823416	221.3	0.200	1
ALC2009	0.98	168.0	0	0.39	0.79	9139799	329.0	0.177	0
ALC2010	1.00	168.0	0	0.40	0.78	9383242	329.9	0.183	0
ALC2011	1.00	168.0	0	0.34	0.80	9914032	331.5	0.192	0
BCN2009	0.95	168.0	0	0.34	0.63	27430664	693.1	0.100	0
BCN2010	1.00	168.0	0	0.35	0.60	29219964	695.1	0.108	0
BCN2011	1.00	168.0	0	0.30	0.60	34407883	695.4	0.115	0
BIO2009	0.92	117.3	0	0.33	0.26	3655226	513.8	0.095	0
BIO2010	0.93	117.3	0	0.34	0.26	3889210	513.7	0.099	0
BIO2011	0.94	117.3	0	0.31	0.31	4046435	512.2	0.103	0
BJZ2009	1.00	80.5	0	0.21	0.03	75351	31.8	0.103	1
BJZ2010	1.00	80.5	0	0.56	0.04	61179	31.8	0.128	1

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
BJZ2011	1.00	80.5	0	0.40	0.04	56981	31.9	0.108	1
EAS2009	0.72	98.0	0	0.35	0.01	315297	350.0	0.089	0
EAS2010	0.74	98.0	0	0.37	0.01	286079	349.9	0.086	0
EAS2011	0.75	98.0	0	0.42	0.02	248053	349.1	0.084	0
FUE2009	0.73	108.5	0	0.42	0.67	3738683	56.7	0.062	0
FUE2010	0.80	108.5	0	0.42	0.71	4173761	56.8	0.084	0
FUE2011	0.82	108.5	0	0.38	0.75	4948174	56.8	0.073	0
GMZ2009	0.85	70.0	0	0.79	0.00	34606	61.2	0.061	0
GMZ2010	0.85	70.0	0	0.82	0.00	32489	61.5	0.121	0
GMZ2011	1.00	70.0	0	0.78	0.00	32714	61.5	0.110	0
GRO2009	1.00	168.0	0	0.33	0.87	5286977	123.0	0.158	0
GRO2010	1.00	168.0	0	0.34	0.83	4863960	123.2	0.208	0
GRO2011	0.76	168.0	0	0.35	0.93	3007983	123.6	0.202	0
GRX2009	0.69	113.8	0	0.30	0.17	1187817	71.8	0.071	0
GRX2010	0.67	113.8	0	0.34	0.11	978258	72.2	0.079	0
GRX2011	0.66	113.8	0	0.33	0.07	872755	72.4	0.060	0
IBZ2009	0.81	115.5	0	0.32	0.56	4573133	203.0	0.478	0
IBZ2010	0.91	115.5	0	0.33	0.57	5041100	207.2	0.488	0
IBZ2011	0.87	115.5	0	0.28	0.58	5643456	207.2	0.479	0
LCG2009	0.70	126.0	0	0.28	0.09	1068847	142.6	0.066	0
LCG2010	0.69	126.0	0	0.30	0.11	1101233	142.7	0.068	0
LCG2011	0.69	126.0	0	0.39	0.13	1012825	142.7	0.060	0

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
LEI2009	0.61	115.5	0	0.46	0.49	791839	78.1	0.148	0
LEI2010	0.64	115.5	0	0.49	0.36	786878	78.7	0.128	0
LEI2011	0.65	115.5	0	0.46	0.39	780854	78.9	0.156	0
LEN2009	0.78	80.5	0	0.28	0.07	95189	31.1	0.133	1
LEN2010	0.77	80.5	0	0.51	0.04	93373	31.0	0.157	1
LEN2011	0.82	80.5	0	0.57	0.06	85726	30.9	0.164	1
LPA2009	0.95	168.0	0	0.38	0.55	9158265	539.9	0.073	1
LPA2010	1.00	168.0	0	0.38	0.55	9488488	542.6	0.067	1
LPA2011	0.99	168.0	0	0.34	0.57	10541197	542.6	0.066	1
MAH2009	0.62	105.0	0	0.33	0.45	2433928	131.0	0.440	0
MAH2010	0.68	105.0	0	0.33	0.45	2511869	131.5	0.456	0
MAH2011	0.66	105.0	0	0.29	0.47	2576407	131.5	0.467	0
MJV2009	0.90	105.0	0	0.39	0.93	1630685	128.6	0.232	1
MJV2010	0.79	105.0	0	0.42	0.92	1349579	129.7	0.310	1
MJV2011	0.74	105.0	0	0.42	0.92	1262597	130.4	0.347	1
MLN2009	0.68	73.5	0	0.28	0.00	293730	5316.6	0.050	0
MLN2010	0.70	73.5	0	0.23	0.00	292642	5466.0	0.046	0
MLN2011	0.73	73.5	0	0.28	0.00	286728	5611.0	0.054	0
ODB2009	1.00	42.0	0	0.68	0.02	15474	57.5	0.202	0
ODB2010	0.94	42.0	0	0.76	0.04	7852	57.6	0.314	0
ODB2011	1.00	42.0	0	0.59	0.01	8442	57.7	0.166	0
OVD2009	0.70	113.8	0	0.30	0.13	1316223	100.1	0.099	0

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
OVD2010	0.73	113.8	0	0.30	0.12	1355375	99.9	0.114	0
OVD2011	0.68	113.8	0	0.32	0.12	1339024	99.7	0.091	0
PMI2009	0.98	168.0	0	0.29	0.70	21204750	233.6	0.300	1
PMI2010	1.00	168.0	0	0.29	0.71	21119146	235.3	0.319	1
PMI2011	1.00	168.0	0	0.24	0.73	22728285	235.3	0.343	1
PNA2009	0.67	105.0	0	0.34	0.03	335617	59.6	0.102	0
PNA2010	0.66	105.0	0	0.35	0.04	291557	60.0	0.105	0
PNA2011	0.65	105.0	0	0.36	0.04	238514	60.2	0.091	0
REU2009	0.81	98.0	0	0.27	0.78	1706616	126.8	0.388	0
REU2010	0.86	98.0	0	0.30	0.85	1419876	127.3	0.427	0
REU2011	0.75	98.0	0	0.29	0.87	1362687	127.8	0.464	0
RGS2009	0.89	28.0	0	0.28	0.14	27716	25.6	0.199	0
RGS2010	0.85	28.0	0	0.30	0.09	33595	25.4	0.274	0
RGS2011	1.00	28.0	0	0.17	0.16	35447	25.3	0.226	0
RJL2009	0.78	35.0	0	0.48	0.01	35663	62.6	0.213	0
RJL2010	0.71	35.0	0	0.46	0.12	24527	62.3	0.233	0
RJL2011	0.75	35.0	0	0.49	0.04	17877	62.2	0.164	0
SCQ2009	0.62	168.0	0	0.34	0.13	1944267	142.6	0.104	1
SCQ2010	0.65	168.0	0	0.36	0.12	2173065	142.7	0.105	1
SCQ2011	0.64	168.0	0	0.35	0.10	2464509	142.7	0.117	1
SDR2009	0.83	108.5	0	0.30	0.36	958158	109.7	0.111	0
SDR2010	0.77	108.5	0	0.31	0.35	919871	109.9	0.131	0

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
SDR2011	0.84	108.5	0	0.27	0.32	1116398	110.0	0.129	0
SLM2009	1.00	45.5	0	0.19	0.10	53088	28.3	0.316	1
SLM2010	1.00	45.5	0	0.30	0.09	43179	28.2	0.353	1
SLM2011	1.00	45.5	0	0.17	0.08	37257	28.1	0.263	1
SPC2009	0.67	94.5	0	0.52	0.24	1043382	123.5	0.050	0
SPC2010	0.66	94.5	0	0.56	0.24	992457	123.8	0.066	0
SPC2011	0.67	94.5	0	0.55	0.22	1067516	123.8	0.054	0
SVQ2009	0.77	129.5	0	0.35	0.28	4051890	134.1	0.090	0
SVQ2010	0.79	129.5	0	0.34	0.31	4225265	135.1	0.070	0
SVQ2011	0.82	129.5	0	0.28	0.33	4959872	135.9	0.088	0
TFN2009	1.00	117.3	0	0.36	0.04	4055978	436.5	0.060	0
TFN2010	1.00	117.3	0	0.38	0.02	4052950	440.0	0.055	0
TFN2011	0.96	117.3	0	0.34	0.01	4096678	440.0	0.055	0
TFS2009	0.73	168.0	0	0.42	0.84	7108592	436.5	0.080	0
TFS2010	0.80	168.0	0	0.42	0.85	7359415	440.0	0.080	0
TFS2011	0.90	168.0	0	0.35	0.88	8656935	440.0	0.071	0
VDE2009	1.00	70.0	0	0.64	0.00	183906	38.8	0.067	0
VDE2010	1.00	70.0	0	0.71	0.00	170983	39.2	0.067	0
VDE2011	1.00	70.0	0	0.63	0.00	170239	39.2	0.071	0
VGO2009	0.69	126.0	0	0.30	0.09	1103365	211.8	0.089	0
VGO2010	0.66	126.0	0	0.30	0.09	1093666	212.3	0.091	0
VGO2011	0.59	126.0	0	0.32	0.12	976263	212.3	0.076	0

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
VIT2009	0.79	84.0	0	0.30	0.05	42672	513.8	0.181	0
VIT2010	0.80	84.0	0	0.34	0.07	44869	513.7	0.337	0
VIT2011	1.00	84.0	0	0.34	0.12	31680	512.2	0.485	0
VLC2009	1.00	168.0	0	0.34	0.51	4749976	235.1	0.124	0
VLC2010	1.00	168.0	0	0.35	0.53	4935411	235.2	0.114	0
VLC2011	0.93	168.0	0	0.34	0.62	4980562	235.2	0.111	0
VLL2009	0.74	89.3	0	0.34	0.60	365728	65.0	0.171	1
VLL2010	0.76	89.3	0	0.37	0.52	392692	65.1	0.186	1
VLL2011	0.67	89.3	0	0.37	0.35	462509	65.2	0.138	1
XRY2009	0.93	112.0	0	0.44	0.36	1079628	169.0	0.176	0
XRY2010	0.84	112.0	0	0.46	0.38	1043176	169.9	0.179	0
XRY2011	1.00	112.0	0	0.46	0.37	1032498	170.7	0.211	0
ZAZ2009	0.96	113.8	0	0.21	0.58	532002	55.3	0.131	1
ZAZ2010	1.00	113.8	0	0.21	0.61	610166	55.5	0.173	1
ZAZ2011	1.00	113.8	0	0.22	0.58	755962	55.7	0.116	1
ADA2009	0.70	168.0	0	0.49	0.17	2482958	146.9	0.053	0
ADA2010	0.79	168.0	0	0.48	0.15	2842016	149.0	0.034	0
ADA2011	0.79	168.0	0	0.49	0.18	3241533	149.0	0.036	0
ADB2009	0.65	168.0	1	0.37	0.27	6203141	319.0	0.125	0
ADB2010	0.92	168.0	1	0.45	0.28	7486871	325.4	0.118	0
ADB2011	1.00	168.0	1	0.41	0.28	8525192	325.4	0.113	0
ADF2009	1.00	59.5	0	0.67	0.00	85117	83.4	0.055	0

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
ADF2010	0.98	59.5	0	0.53	0.00	108513	83.8	0.048	0
ASR2009	0.66	168.0	0	0.44	0.27	778667	70.1	0.140	1
ASR2010	0.66	168.0	0	0.42	0.23	940278	71.6	0.117	1
ASR2011	0.67	168.0	0	0.42	0.21	1223795	71.6	0.134	1
AYT2009	0.95	168.0	1	0.54	0.83	18346379	91.2	0.391	0
AYT2010	1.00	168.0	1	0.58	0.83	22013917	94.1	0.381	0
AYT2011	1.00	168.0	1	0.53	0.82	25028398	94.1	0.365	0
BJV2009	0.68	168.0	1	0.45	0.65	2780968	62.0	0.536	0
BJV2010	0.71	168.0	1	0.64	0.62	3085201	63.0	0.521	0
BJV2011	0.73	168.0	1	0.63	0.59	3388348	63.0	0.515	0
DIY2009	0.82	168.0	0	0.46	0.01	1060476	99.9	0.039	1
DIY2010	1.00	168.0	0	0.53	0.01	1404691	101.1	0.056	1
DIY2011	0.93	168.0	0	0.47	0.01	1733464	101.1	0.068	1
DLM2009	0.70	168.0	1	0.23	0.86	3348046	62.0	0.562	1
DLM2010	0.74	168.0	1	0.26	0.84	3785798	63.0	0.545	1
DLM2011	0.73	168.0	1	0.17	0.81	3732394	63.0	0.538	1
DNZ2009	0.57	168.0	0	0.60	0.02	150780	78.9	0.055	1
DNZ2011	0.52	168.0	0	0.43	0.04	174644	79.5	0.046	1
ERC2009	0.65	61.5	0	0.71	0.00	127031	18.2	0.118	1
ERC2011	0.56	61.5	0	0.55	0.00	207077	18.9	0.127	1
ERZ2009	0.57	168.0	0	0.53	0.03	599020	30.6	0.073	1
ERZ2010	0.61	168.0	0	0.60	0.02	765085	30.5	0.051	1

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
ERZ2011	0.55	168.0	0	0.54	0.02	805374	30.5	0.052	1
ESB2009	0.66	168.0	1	0.11	0.18	6085748	187.6	0.059	0
ESB2010	0.82	168.0	1	0.25	0.17	7765424	192.1	0.075	0
ESB2011	1.00	168.0	1	0.23	0.17	8486989	192.1	0.042	0
EZS2009	0.66	168.0	0	0.55	0.00	344855	64.9	0.366	1
EZS2010	0.71	168.0	0	0.48	0.05	470068	65.2	0.072	1
EZS2011	0.70	168.0	0	0.32	0.06	549072	65.2	0.111	1
GNY2009	0.47	126.0	0	0.66	0.02	181158	84.9	0.082	0
GNY2010	0.48	126.0	0	0.49	0.02	221040	87.3	0.056	0
GNY2011	0.47	126.0	0	0.35	0.03	231330	87.3	0.071	0
GZT2009	0.54	168.0	0	0.51	0.15	833083	239.5	0.085	0
GZT2010	0.56	168.0	0	0.44	0.09	1040064	246.0	0.046	0
GZT2011	0.57	168.0	0	0.44	0.11	1314615	246.0	0.050	0
HTY2009	0.74	168.0	0	0.73	0.28	325310	245.5	0.061	0
HTY2010	0.77	168.0	0	0.40	0.24	574629	251.3	0.094	0
HTY2011	0.67	168.0	0	0.40	0.20	689592	251.3	0.072	0
ISE2010	0.59	51.0	0	0.52	0.23	33411	52.5	0.229	0
KCM2009	0.89	55.0	0	0.86	0.00	81423	72.0	0.090	0
KCM2011	0.74	55.0	0	0.41	0.00	95746	72.6	0.034	0
KSY2009	0.68	63.0	0	0.51	0.01	288012	30.5	0.056	0
KSY2010	0.68	63.0	0	0.40	0.01	332290	30.0	0.070	0
KSY2011	0.65	63.0	0	0.38	0.00	377588	30.0	0.041	0

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
KYA2009	0.64	168.0	0	0.39	0.11	301724	51.0	0.150	1
KYA2010	0.68	168.0	0	0.42	0.09	545499	51.5	0.081	1
KYA2011	0.64	168.0	0	0.34	0.12	600881	51.5	0.077	1
MLX2009	0.86	168.0	0	0.54	0.05	462925	62.4	0.088	1
MLX2010	0.78	168.0	0	0.44	0.03	520487	62.7	0.080	1
MLX2011	0.67	168.0	0	0.47	0.03	570636	62.7	0.082	1
MQM2009	0.86	122.5	0	0.63	0.00	233288	84.5	0.049	0
MQM2010	0.76	122.5	0	0.40	0.00	305933	84.2	0.087	0
MSR2009	0.82	67.0	0	0.31	0.01	115796	50.2	0.096	1
MSR2010	0.80	67.0	0	0.52	0.01	179811	50.3	0.043	1
MSR2011	0.77	67.0	0	0.32	0.00	196551	50.3	0.052	1
MZH2009	0.92	73.5	0	0.52	0.00	39577	56.9	0.169	1
MZH2010	0.83	73.5	0	0.43	0.01	64393	57.9	0.142	1
NAV2009	0.53	79.8	0	0.33	0.32	122756	52.6	0.255	0
NAV2010	0.54	79.8	0	0.15	0.29	137909	52.6	0.199	0
NAV2011	0.53	79.8	0	0.14	0.19	157793	52.6	0.258	0
SZF2009	0.58	168.0	0	0.58	0.10	866868	136.7	0.104	0
SZF2010	0.58	168.0	0	0.51	0.07	957391	137.8	0.047	0
SZF2011	0.61	168.0	0	0.51	0.08	1155192	137.8	0.055	0
TEQ2009	0.89	168.0	0	0.35	0.25	40910	123.1	0.326	1
TEQ2010	1.00	168.0	0	0.16	0.14	74738	125.3	0.178	1
TEQ2011	1.00	168.0	0	0.13	0.01	43305	125.3	0.113	1

DMU	DEA Score	weekly opening hours	bot (ppp) partnership (dummy)	share of commercial revenues	percentage of international traffic	work load unit (airport size)	population density	seasonality measured by gini	joint military-civil airport (dummy)
TZX2009	0.62	168.0	0	0.54	0.04	1597050	162.3	0.070	0
TZX2010	0.65	168.0	0	0.58	0.03	1963370	163.9	0.067	0
TZX2011	0.66	168.0	0	0.55	0.04	2280303	163.9	0.081	0
USQ2011	0.78	42.5	0	0.41	0.00	15267	63.1	0.361	1
VAN2009	0.79	168.0	0	0.69	0.00	745542	52.5	0.055	0
VAN2010	0.82	168.0	0	0.57	0.00	892124	53.3	0.054	0
VAN2011	0.80	168.0	0	0.54	0.00	1057259	53.3	0.072	0
VAS2009	0.73	168.0	0	0.69	0.02	124143	22.1	0.061	0
VAS2010	0.60	168.0	0	0.40	0.04	111463	22.3	0.069	0
VAS2011	0.54	168.0	0	0.54	0.03	228606	22.3	0.181	0
YEI2009	0.48	168.0	0	0.46	0.18	73535	242.7	0.137	1
YEI2010	0.47	168.0	0	0.31	0.35	97546	247.4	0.183	1
YEI2011	0.47	168.0	0	0.25	0.40	111554	247.4	0.147	1

STATA output to the second stage regression

```
. regress lndeascore lnwoh bot lncomrev lninttra lnwlu lnpopdens lngini military spain d2010 d2011

      Source |       SS       df       MS              Number of obs =     209
-------------+------------------------------           F( 11,   197) =    7.32
       Model |  2.45971904    11  .223610821           Prob > F      =  0.0000
    Residual |  6.01489023   197  .030532438           R-squared     =  0.2902
-------------+------------------------------           Adj R-squared =  0.2506
       Total |  8.47460927   208  .040743314           Root MSE      =  .17474

------------------------------------------------------------------------------
  lndeascore |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnwoh |  -.1318401   .0495194    -2.66   0.008    -.2294962    -.034184
         bot |   .1659497   .0617714     2.69   0.008     .0441317    .2877677
    lncomrev |    .046518   .0395766     1.18   0.241    -.0315303    .1245663
    lninttra |   -.023412   .0144839    -1.62   0.108    -.0519755    .0051514
       lnwlu |   .0338414   .0125525     2.70   0.008      .009087    .0585959
   lnpopdens |   .0183298   .0161925     1.13   0.259    -.0136031    .0502627
      lngini |   .0257246   .0242221     1.06   0.290    -.0220433    .0734925
    military |   .0976554   .0289224     3.38   0.001     .0406182    .1546926
       spain |   .1781937   .0371658     4.79   0.000     .1048999    .2514876
       d2010 |   .0187536   .0295598     0.63   0.527    -.0395407     .077048
       d2011 |   .0063089   .0297591     0.21   0.832    -.0523785    .0649962
       _cons |  -.2827866   .1949167    -1.45   0.148    -.6671777    .1016044
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Appendix to Chapter 4

Dependent and independent variables from Norwegian airports used for the spatial regression

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2002	56.35	8311	1.50	8.17	83%	1	6.09
Anonymised	Anonymised	2003	68.67	9258	1.17	7.00	76%	1	142.26
Anonymised	Anonymised	2007	116.67	11357	0.93	7.52	12%	1	33.60
Anonymised	Anonymised	2008	182.45	8439	0.93	7.68	78%	1	33.39
Anonymised	Anonymised	2007	163.47	8863	0.92	6.53	78%	1	95.86
Anonymised	Anonymised	2002	46.69	13349	0.92	9.31	11%	0	4.92
Anonymised	Anonymised	2006	165.94	8367	0.92	7.52	80%	1	102.70
Anonymised	Anonymised	2009	101.99	12901	0.92	6.77	8%	1	27.68
Anonymised	Anonymised	2008	119.08	12100	0.92	7.01	8%	1	15.39
Anonymised	Anonymised	2010	97.78	14507	0.92	6.50	11%	1	29.98
Anonymised	Anonymised	2006	100.12	11026	0.92	7.44	9%	1	34.66
Anonymised	Anonymised	2006	124.91	7767	0.91	7.66	14%	1	38.14
Anonymised	Anonymised	2009	120.47	13271	0.91	7.04	66%	1	23.78
Anonymised	Anonymised	2005	128.64	7963	0.91	7.36	12%	1	39.97
Anonymised	Anonymised	2007	110.92	9428	0.91	7.14	13%	1	31.56
Anonymised	Anonymised	2008	125.12	9390	0.91	7.56	14%	1	17.07
Anonymised	Anonymised	2010	130.05	10590	0.90	10.04	16%	1	21.07
Anonymised	Anonymised	2005	97.45	10617	0.90	8.08	12%	1	33.41
Anonymised	Anonymised	2005	113.63	10758	0.90	7.33	83%	1	76.40
Anonymised	Anonymised	2009	89.61	16075	0.90	7.45	7%	1	21.79
Anonymised	Anonymised	2010	98.88	15123	0.89	7.89	6%	1	24.15

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2004	116.32	10349	0.89	10.41	80%	1	81.37
Anonymised	Anonymised	2009	116.26	10524	0.89	9.88	15%	1	21.09
Anonymised	Anonymised	2006	71.88	18223	0.89	7.45	17%	1	20.57
Anonymised	Anonymised	2007	80.33	15903	0.88	7.32	8%	1	21.64
Anonymised	Anonymised	2009	69.10	26278	0.88	6.53	6%	1	11.49
Anonymised	Anonymised	2009	64.41	23574	0.88	6.46	13%	1	12.59
Anonymised	Anonymised	2008	83.65	16630	0.88	7.24	7%	1	55.96
Anonymised	Anonymised	2005	88.06	15402	0.88	9.47	22%	1	24.63
Anonymised	Anonymised	2008	64.46	25735	0.88	6.59	9%	0	8.31
Anonymised	Anonymised	2006	95.37	12831	0.88	9.24	7%	1	25.99
Anonymised	Anonymised	2006	72.55	21440	0.88	7.91	11%	0	18.96
Anonymised	Anonymised	2007	61.65	24363	0.88	6.87	10%	0	18.21
Anonymised	Anonymised	2007	62.53	20958	0.88	6.87	14%	1	17.21
Anonymised	Anonymised	2008	66.63	21463	0.88	6.85	15%	1	10.32
Anonymised	Anonymised	2010	64.58	23182	0.88	6.55	11%	1	12.86
Anonymised	Anonymised	2010	70.75	24433	0.87	7.05	12%	0	8.23
Anonymised	Anonymised	2010	72.45	22920	0.87	6.25	16%	1	8.03
Anonymised	Anonymised	2010	65.59	27227	0.87	6.77	11%	1	10.01
Anonymised	Anonymised	2005	101.43	13772	0.86	9.30	35%	1	31.92
Anonymised	Anonymised	2009	64.51	25860	0.86	6.70	10%	0	8.98
Anonymised	Anonymised	2005	87.64	18395	0.86	11.12	8%	0	21.84
Anonymised	Anonymised	2005	95.14	12143	0.86	10.25	6%	1	27.40
Anonymised	Anonymised	2007	57.82	26200	0.86	6.74	10%	0	27.53
Anonymised	Anonymised	2010	51.41	27931	0.86	6.01	11%	0	6.52
Anonymised	Anonymised	2004	79.43	8989	0.85	7.87	10%	1	35.40

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2008	53.73	24903	0.85	6.52	9%	0	6.50
Anonymised	Anonymised	2009	53.49	24921	0.85	6.43	9%	0	8.57
Anonymised	Anonymised	2009	46.92	37598	0.85	6.30	14%	1	8.55
Anonymised	Anonymised	2010	114.70	15812	0.85	7.29	69%	1	17.35
Anonymised	Anonymised	2005	61.02	44067	0.84	7.76	5%	0	3.44
Anonymised	Anonymised	2009	53.49	33986	0.84	7.36	26%	1	9.06
Anonymised	Anonymised	2008	55.45	26816	0.84	6.53	10%	0	7.21
Anonymised	Anonymised	2010	68.35	24279	0.84	8.18	18%	1	9.45
Anonymised	Anonymised	2006	104.94	34977	0.84	8.28	8%	0	4.38
Anonymised	Anonymised	2007	49.57	24437	0.84	6.97	11%	0	14.75
Anonymised	Anonymised	2009	62.23	25872	0.84	7.84	16%	1	9.84
Anonymised	Anonymised	2008	46.53	38705	0.84	6.20	12%	1	6.58
Anonymised	Anonymised	2006	60.32	22152	0.84	7.95	14%	0	34.10
Anonymised	Anonymised	2009	75.02	48251	0.83	6.59	3%	1	2.23
Anonymised	Anonymised	2007	53.45	23867	0.83	8.17	15%	1	15.21
Anonymised	Anonymised	2010	46.21	39031	0.83	6.33	22%	1	9.56
Anonymised	Anonymised	2007	38.09	43716	0.83	5.99	15%	1	9.65
Anonymised	Anonymised	2008	56.49	25790	0.83	7.65	15%	1	10.98
Anonymised	Anonymised	2005	64.76	21705	0.83	8.96	12%	0	35.53
Anonymised	Anonymised	2005	69.64	19305	0.83	10.64	10%	1	18.86
Anonymised	Anonymised	2006	53.25	26618	0.83	7.74	29%	1	19.22
Anonymised	Anonymised	2007	39.74	38574	0.83	6.16	10%	1	10.88
Anonymised	Anonymised	2010	55.18	33061	0.82	7.45	27%	1	10.67
Anonymised	Anonymised	2003	58.86	13508	0.82	9.22	10%	1	19.59
Anonymised	Anonymised	2008	42.89	37609	0.82	6.66	30%	1	5.49

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2009	47.10	35380	0.82	6.33	15%	1	9.21
Anonymised	Anonymised	2007	82.78	43071	0.82	6.97	4%	0	3.61
Anonymised	Anonymised	2010	46.84	37650	0.82	6.15	13%	1	7.77
Anonymised	Anonymised	2005	43.56	36990	0.82	7.16	18%	1	11.06
Anonymised	Anonymised	2006	39.30	40281	0.82	6.50	17%	1	12.64
Anonymised	Anonymised	2008	71.86	46804	0.82	6.77	2%	0	1.96
Anonymised	Anonymised	2010	68.10	50316	0.82	6.68	3%	1	2.35
Anonymised	Anonymised	2002	33.80	20596	0.81	9.13	15%	0	5.54
Anonymised	Anonymised	2006	56.31	22037	0.81	9.28	12%	1	16.47
Anonymised	Anonymised	2008	39.71	44443	0.81	6.17	19%	1	4.06
Anonymised	Anonymised	2006	45.08	34501	0.81	6.80	11%	1	14.83
Anonymised	Anonymised	2005	55.60	20704	0.81	8.77	12%	0	17.12
Anonymised	Anonymised	2003	61.65	11121	0.81	7.50	17%	1	26.88
Anonymised	Anonymised	2006	45.22	23502	0.81	7.14	10%	0	15.45
Anonymised	Anonymised	2007	39.70	34497	0.81	7.11	27%	1	13.54
Anonymised	Anonymised	2007	35.16	33777	0.81	6.10	7%	1	15.17
Anonymised	Anonymised	2009	40.83	44715	0.80	6.24	13%	1	5.35
Anonymised	Anonymised	2010	229.56	6450	0.80	14.57	57%	1	49.33
Anonymised	Anonymised	2005	42.70	28819	0.80	7.41	8%	1	18.58
Anonymised	Anonymised	2004	55.90	44055	0.80	10.45	8%	0	3.41
Anonymised	Anonymised	2008	36.38	35258	0.80	6.09	10%	1	7.10
Anonymised	Anonymised	2002	51.64	11133	0.79	7.65	18%	1	7.75
Anonymised	Anonymised	2005	43.68	33720	0.79	7.51	10%	1	12.59
Anonymised	Anonymised	2004	81.64	14322	0.79	12.94	31%	1	33.81
Anonymised	Anonymised	2006	36.56	30560	0.79	6.65	8%	1	18.75

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2002	61.16	11203	0.78	2.80	16%	0	9.23
Anonymised	Anonymised	2003	43.27	20717	0.78	9.47	14%	0	12.15
Anonymised	Anonymised	2003	47.18	18126	0.78	7.68	22%	1	18.70
Anonymised	Anonymised	2007	29.98	54414	0.77	6.16	24%	1	6.53
Anonymised	Anonymised	2002	38.15	17660	0.77	8.04	23%	1	7.62
Anonymised	Anonymised	2002	22.91	29035	0.76	7.07	8%	1	3.09
Anonymised	Anonymised	2009	247.00	5850	0.76	14.48	57%	1	57.44
Anonymised	Anonymised	2009	32.92	77084	0.75	6.45	9%	1	4.93
Anonymised	Anonymised	2008	24.39	94661	0.75	5.23	9%	1	3.93
Anonymised	Anonymised	2009	25.13	93985	0.75	5.39	7%	1	4.57
Anonymised	Anonymised	2006	28.81	49845	0.75	6.43	27%	1	7.18
Anonymised	Anonymised	2008	32.99	72426	0.75	6.52	9%	1	3.59
Anonymised	Anonymised	2005	30.49	44843	0.75	7.07	26%	1	7.82
Anonymised	Anonymised	2009	81.28	56990	0.75	6.78	25%	1	9.22
Anonymised	Anonymised	2007	30.31	76324	0.74	6.37	10%	1	8.05
Anonymised	Anonymised	2010	82.12	58362	0.74	6.87	24%	1	9.46
Anonymised	Anonymised	2007	21.08	95986	0.73	5.08	8%	1	5.81
Anonymised	Anonymised	2004	78.44	10904	0.73	19.62	12%	1	29.34
Anonymised	Anonymised	2010	24.66	88796	0.73	5.51	9%	1	3.88
Anonymised	Anonymised	2010	31.53	73157	0.73	7.41	13%	1	5.18
Anonymised	Anonymised	2006	21.15	93248	0.72	5.52	6%	1	5.83
Anonymised	Anonymised	2008	74.20	59724	0.72	6.58	26%	1	11.61
Anonymised	Anonymised	2009	29.66	75426	0.72	7.23	9%	1	4.86
Anonymised	Anonymised	2003	59.59	9363	0.71	5.91	12%	1	30.87
Anonymised	Anonymised	2008	206.24	7419	0.71	14.73	46%	1	29.18

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2004	65.51	16003	0.71	17.65	22%	1	23.52
Anonymised	Anonymised	2006	86.84	15674	0.71	9.21	52%	1	51.47
Anonymised	Anonymised	2003	46.39	18271	0.71	7.51	13%	0	13.76
Anonymised	Anonymised	2007	109.95	12846	0.71	9.18	53%	1	60.51
Anonymised	Anonymised	2009	26.77	88957	0.71	6.47	16%	1	3.53
Anonymised	Anonymised	2005	22.54	83290	0.71	6.15	7%	1	6.01
Anonymised	Anonymised	2007	75.37	55051	0.71	6.70	22%	1	10.56
Anonymised	Anonymised	2006	28.90	70488	0.70	6.90	9%	1	8.94
Anonymised	Anonymised	2010	29.17	80047	0.70	6.73	11%	1	5.12
Anonymised	Anonymised	2007	24.34	87463	0.70	6.22	12%	1	5.43
Anonymised	Anonymised	2006	74.36	56099	0.70	7.14	21%	1	9.71
Anonymised	Anonymised	2004	69.39	18861	0.69	19.79	9%	0	17.91
Anonymised	Anonymised	2008	27.96	66218	0.69	7.76	8%	1	4.48
Anonymised	Anonymised	2009	24.69	99555	0.69	6.53	19%	1	2.70
Anonymised	Anonymised	2009	23.92	130894	0.69	6.20	23%	1	4.22
Anonymised	Anonymised	2009	25.82	81157	0.68	6.83	38%	0	2.99
Anonymised	Anonymised	2010	25.57	93709	0.68	6.50	15%	1	3.04
Anonymised	Anonymised	2009	22.95	91830	0.68	6.32	21%	0	3.78
Anonymised	Anonymised	2004	60.04	21436	0.68	17.46	12%	0	14.20
Anonymised	Anonymised	2010	26.00	123295	0.68	6.73	26%	1	4.44
Anonymised	Anonymised	2004	90.31	12267	0.68	25.98	9%	1	24.14
Anonymised	Anonymised	2007	25.74	71540	0.68	7.45	8%	1	4.56
Anonymised	Anonymised	2008	23.69	78541	0.68	6.26	24%	1	2.58
Anonymised	Anonymised	2004	35.13	36775	0.67	10.53	26%	1	9.80
Anonymised	Anonymised	2008	25.32	79633	0.67	6.85	43%	0	2.49

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2006	25.25	77264	0.67	6.97	16%	1	6.49
Anonymised	Anonymised	2003	29.30	31314	0.67	6.44	24%	1	10.41
Anonymised	Anonymised	2003	28.50	31058	0.67	7.09	13%	1	11.10
Anonymised	Anonymised	2002	119.93	6010	0.67	11.10	66%	1	20.35
Anonymised	Anonymised	2003	19.27	39019	0.67	6.16	35%	1	5.58
Anonymised	Anonymised	2004	45.85	21168	0.66	12.98	11%	0	14.32
Anonymised	Anonymised	2005	27.79	68303	0.66	7.52	12%	1	8.73
Anonymised	Anonymised	2010	24.45	99379	0.66	6.65	20%	1	2.96
Anonymised	Anonymised	2010	21.41	102042	0.66	6.15	8%	1	5.86
Anonymised	Anonymised	2005	73.83	17722	0.66	9.99	53%	1	44.76
Anonymised	Anonymised	2004	47.09	22730	0.66	14.21	12%	0	33.33
Anonymised	Anonymised	2006	26.16	64025	0.66	8.00	10%	1	5.55
Anonymised	Anonymised	2010	25.10	82006	0.65	6.78	44%	0	2.86
Anonymised	Anonymised	2010	21.65	98244	0.65	6.28	24%	0	3.56
Anonymised	Anonymised	2007	22.78	76287	0.65	6.68	44%	0	6.30
Anonymised	Anonymised	2009	21.24	99785	0.65	6.18	7%	1	5.44
Anonymised	Anonymised	2005	24.10	66933	0.65	7.65	48%	0	7.66
Anonymised	Anonymised	2008	23.13	89042	0.65	6.72	19%	1	2.25
Anonymised	Anonymised	2009	22.05	111107	0.64	6.43	15%	1	3.22
Anonymised	Anonymised	2010	22.18	106800	0.64	6.51	15%	1	3.25
Anonymised	Anonymised	2006	22.31	71050	0.64	7.05	43%	0	7.01
Anonymised	Anonymised	2008	21.29	99565	0.64	6.34	8%	1	6.46
Anonymised	Anonymised	2002	29.68	14956	0.63	6.71	10%	1	4.49
Anonymised	Anonymised	2005	72.22	52999	0.63	7.87	23%	1	7.96
Anonymised	Anonymised	2006	22.25	87492	0.63	6.85	18%	1	4.20

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2007	19.14	100729	0.62	6.19	9%	1	4.43
Anonymised	Anonymised	2009	22.17	105624	0.62	6.41	21%	1	2.72
Anonymised	Anonymised	2002	19.72	34829	0.62	6.27	34%	1	1.84
Anonymised	Anonymised	2007	20.27	90128	0.62	6.58	17%	1	4.95
Anonymised	Anonymised	2003	34.60	24134	0.62	7.45	15%	0	30.07
Anonymised	Anonymised	2006	23.71	227883	0.62	6.50	22%	1	8.02
Anonymised	Anonymised	2002	25.75	30366	0.62	6.67	33%	1	3.78
Anonymised	Anonymised	2002	28.04	29174	0.62	7.39	17%	1	4.18
Anonymised	Anonymised	2003	27.82	29840	0.62	6.51	9%	1	15.05
Anonymised	Anonymised	2008	20.87	106928	0.61	6.55	16%	1	2.61
Anonymised	Anonymised	2010	22.42	108876	0.61	6.47	23%	1	2.58
Anonymised	Anonymised	2005	23.70	78046	0.61	7.42	20%	1	6.15
Anonymised	Anonymised	2007	25.50	99525	0.61	8.40	31%	0	13.22
Anonymised	Anonymised	2007	19.01	104168	0.61	6.36	14%	1	4.92
Anonymised	Anonymised	2010	26.68	333632	0.61	6.42	28%	0	6.71
Anonymised	Anonymised	2003	40.76	23268	0.60	6.62	28%	1	18.42
Anonymised	Anonymised	2002	25.86	31935	0.60	6.91	11%	0	3.37
Anonymised	Anonymised	2005	24.60	61557	0.60	8.71	12%	1	5.44
Anonymised	Anonymised	2004	20.71	64150	0.60	7.44	48%	0	7.62
Anonymised	Anonymised	2006	20.18	91522	0.60	6.83	9%	1	5.19
Anonymised	Anonymised	2008	20.86	140118	0.60	7.37	28%	1	2.71
Anonymised	Anonymised	2008	20.44	103664	0.59	6.38	20%	1	2.34
Anonymised	Anonymised	2004	18.84	83490	0.59	7.37	9%	1	4.75
Anonymised	Anonymised	2009	30.45	99754	0.59	9.35	38%	0	10.34
Anonymised	Anonymised	2009	19.14	334187	0.59	6.28	27%	0	3.60

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2006	20.52	95208	0.59	6.74	19%	1	5.70
Anonymised	Anonymised	2008	27.70	97385	0.59	9.43	34%	0	6.88
Anonymised	Anonymised	2004	26.45	43555	0.58	10.13	27%	1	5.93
Anonymised	Anonymised	2008	29.11	87771	0.58	6.46	19%	1	2.47
Anonymised	Anonymised	2003	34.82	31857	0.58	6.55	11%	0	10.74
Anonymised	Anonymised	2002	27.39	25743	0.58	7.67	13%	0	6.62
Anonymised	Anonymised	2006	18.50	101371	0.58	6.57	15%	1	4.67
Anonymised	Anonymised	2005	21.43	79474	0.58	7.60	20%	1	4.82
Anonymised	Anonymised	2007	17.99	148576	0.58	6.61	25%	1	5.18
Anonymised	Anonymised	2010	22.74	190585	0.58	6.43	36%	0	1.64
Anonymised	Anonymised	2004	39.22	28806	0.58	15.49	10%	1	17.49
Anonymised	Anonymised	2008	22.73	181218	0.57	6.21	39%	0	1.77
Anonymised	Anonymised	2004	38.89	32033	0.57	14.98	10%	1	12.34
Anonymised	Anonymised	2005	25.44	155061	0.57	6.96	75%	1	2.09
Anonymised	Anonymised	2009	23.05	175611	0.57	6.30	39%	0	1.75
Anonymised	Anonymised	2005	19.70	95642	0.57	7.29	16%	1	5.00
Anonymised	Anonymised	2006	24.46	169462	0.57	6.54	68%	1	2.85
Anonymised	Anonymised	2007	18.43	102785	0.57	6.28	19%	1	5.20
Anonymised	Anonymised	2005	19.67	88058	0.57	7.49	9%	1	5.61
Anonymised	Anonymised	2005	20.64	91704	0.56	7.21	20%	1	6.11
Anonymised	Anonymised	2007	19.84	239484	0.56	6.30	21%	1	6.38
Anonymised	Anonymised	2010	18.98	281545	0.56	6.18	24%	1	4.44
Anonymised	Anonymised	2008	18.96	265480	0.56	6.36	21%	1	4.92
Anonymised	Anonymised	2003	18.75	60201	0.55	6.83	51%	0	6.98
Anonymised	Anonymised	2004	28.60	156235	0.55	9.62	77%	1	1.76

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2007	23.08	174987	0.55	6.33	39%	1	2.63
Anonymised	Anonymised	2004	69.82	14550	0.54	12.46	68%	1	53.74
Anonymised	Anonymised	2008	17.15	353239	0.53	6.33	26%	0	1.66
Anonymised	Anonymised	2009	18.53	277736	0.53	6.35	21%	1	4.95
Anonymised	Anonymised	2006	27.59	88317	0.52	10.79	37%	0	10.23
Anonymised	Anonymised	2008	24.22	110922	0.51	10.39	31%	1	5.64
Anonymised	Anonymised	2006	18.72	143621	0.51	7.83	26%	1	5.55
Anonymised	Anonymised	2003	13.21	83490	0.50	5.48	10%	1	4.30
Anonymised	Anonymised	2007	14.91	388640	0.50	6.16	24%	0	2.43
Anonymised	Anonymised	2004	16.00	82681	0.49	6.87	22%	1	4.17
Anonymised	Anonymised	2002	17.65	55635	0.48	7.42	51%	1	2.16
Anonymised	Anonymised	2010	23.01	130404	0.47	9.49	42%	0	7.75
Anonymised	Anonymised	2005	17.52	220913	0.47	6.97	22%	1	5.07
Anonymised	Anonymised	2002	21.61	42345	0.46	7.14	26%	1	3.61
Anonymised	Anonymised	2004	21.63	65481	0.45	10.13	13%	1	8.42
Anonymised	Anonymised	2009	22.38	118195	0.45	10.63	32%	1	5.76
Anonymised	Anonymised	2006	13.51	416332	0.45	6.28	24%	0	2.59
Anonymised	Anonymised	2005	26.72	89071	0.44	11.94	39%	0	10.39
Anonymised	Anonymised	2010	47.68	125858	0.44	7.93	38%	0	12.21
Anonymised	Anonymised	2003	122.61	10493	0.43	8.51	72%	1	60.06
Anonymised	Anonymised	2007	20.19	112044	0.43	10.36	31%	1	10.34
Anonymised	Anonymised	2004	17.79	90669	0.42	8.63	25%	1	5.07
Anonymised	Anonymised	2004	16.82	62489	0.42	8.64	10%	1	6.12
Anonymised	Anonymised	2009	42.00	129412	0.42	7.71	37%	0	12.15
Anonymised	Anonymised	2002	13.02	70255	0.42	6.89	9%	1	2.37

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2008	16.55	337089	0.41	6.60	22%	0	2.56
Anonymised	Anonymised	2009	17.60	352506	0.41	6.84	22%	0	2.48
Anonymised	Anonymised	2005	17.70	135836	0.40	9.13	30%	1	5.71
Anonymised	Anonymised	2004	66.81	58615	0.40	24.16	22%	1	2.53
Anonymised	Anonymised	2004	19.73	77752	0.39	10.36	18%	1	5.59
Anonymised	Anonymised	2006	19.81	104283	0.39	11.07	29%	1	11.29
Anonymised	Anonymised	2007	16.31	498572	0.38	6.27	14%	1	4.36
Anonymised	Anonymised	2004	14.21	96891	0.38	7.82	15%	1	4.52
Anonymised	Anonymised	2010	16.15	159148	0.37	8.64	37%	0	3.89
Anonymised	Anonymised	2005	13.06	358575	0.37	6.86	27%	0	2.98
Anonymised	Anonymised	2003	15.38	79928	0.36	6.08	22%	1	3.23
Anonymised	Anonymised	2007	13.21	406795	0.36	6.34	18%	0	3.11
Anonymised	Anonymised	2002	11.07	84821	0.35	5.88	21%	1	1.17
Anonymised	Anonymised	2004	16.10	136795	0.35	9.36	23%	1	4.49
Anonymised	Anonymised	2010	16.23	393120	0.34	6.92	23%	0	2.26
Anonymised	Anonymised	2004	15.00	308849	0.32	9.21	29%	0	4.11
Anonymised	Anonymised	2002	14.62	73211	0.32	7.12	19%	1	1.95
Anonymised	Anonymised	2003	14.26	118999	0.32	6.31	24%	1	3.92
Anonymised	Anonymised	2005	18.45	111793	0.32	11.65	29%	1	10.12
Anonymised	Anonymised	2003	16.30	70734	0.32	6.64	10%	1	6.74
Anonymised	Anonymised	2004	16.85	214837	0.32	9.45	23%	1	4.43
Anonymised	Anonymised	2004	15.74	89267	0.32	9.74	10%	1	5.45
Anonymised	Anonymised	2002	10.35	71787	0.31	6.33	8%	1	1.02
Anonymised	Anonymised	2003	14.73	93321	0.30	6.30	25%	1	3.89
Anonymised	Anonymised	2003	13.74	64425	0.30	6.83	10%	1	4.24

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2008	41.23	139018	0.30	8.06	27%	0	10.52
Anonymised	Anonymised	2003	15.56	82414	0.29	6.14	17%	1	2.91
Anonymised	Anonymised	2006	14.27	486580	0.29	6.50	13%	1	4.83
Anonymised	Anonymised	2009	15.69	506551	0.29	6.60	16%	1	2.07
Anonymised	Anonymised	2008	14.65	514102	0.28	6.42	16%	1	2.22
Anonymised	Anonymised	2003	14.86	78803	0.28	6.57	16%	1	4.67
Anonymised	Anonymised	2002	11.74	91799	0.28	6.54	23%	1	2.10
Anonymised	Anonymised	2002	12.76	106091	0.27	6.61	26%	1	6.73
Anonymised	Anonymised	2003	11.60	89316	0.27	6.77	10%	1	4.32
Anonymised	Anonymised	2007	38.61	129403	0.26	7.96	32%	0	8.30
Anonymised	Anonymised	2002	11.10	83827	0.26	6.21	18%	1	1.32
Anonymised	Anonymised	2002	10.17	85627	0.25	6.66	11%	1	1.73
Anonymised	Anonymised	2010	14.56	551616	0.23	6.66	13%	1	1.97
Anonymised	Anonymised	2004	20.71	79361	0.23	13.11	33%	0	11.64
Anonymised	Anonymised	2005	13.24	469877	0.22	6.82	15%	1	4.54
Anonymised	Anonymised	2002	11.98	79016	0.22	6.05	7%	1	1.51
Anonymised	Anonymised	2006	35.18	128185	0.22	7.90	33%	0	8.40
Anonymised	Anonymised	2004	18.34	108047	0.21	13.63	29%	1	10.39
Anonymised	Anonymised	2007	14.94	514983	0.21	7.11	21%	1	2.76
Anonymised	Anonymised	2005	10.75	357192	0.20	6.87	23%	0	2.82
Anonymised	Anonymised	2007	10.02	1606553	0.18	5.89	20%	0	1.91
Anonymised	Anonymised	2002	16.66	73792	0.17	11.53	34%	0	4.39
Anonymised	Anonymised	2010	16.14	347572	0.16	10.93	57%	1	1.80
Anonymised	Anonymised	2004	13.80	446016	0.15	8.67	18%	1	4.58
Anonymised	Anonymised	2008	10.03	1647826	0.15	5.93	21%	0	0.82

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2003	18.43	77807	0.15	11.25	37%	0	10.33
Anonymised	Anonymised	2005	40.75	95331	0.15	10.26	32%	0	9.17
Anonymised	Anonymised	2010	17.40	558964	0.13	7.61	25%	1	1.92
Anonymised	Anonymised	2008	20.70	270551	0.13	14.34	55%	1	2.55
Anonymised	Anonymised	2009	9.99	1630279	0.13	5.99	22%	0	0.93
Anonymised	Anonymised	2008	15.12	531762	0.12	7.08	26%	1	1.78
Anonymised	Anonymised	2009	13.16	774338	0.12	6.52	23%	1	0.97
Anonymised	Anonymised	2009	20.43	273314	0.09	15.07	58%	1	2.33
Anonymised	Anonymised	2010	9.78	1649848	0.09	6.13	21%	0	1.07
Anonymised	Anonymised	2004	11.50	321569	0.09	8.91	25%	1	2.97
Anonymised	Anonymised	2004	34.90	93197	0.08	11.00	36%	0	9.34
Anonymised	Anonymised	2006	9.10	444819	0.08	6.34	19%	0	2.48
Anonymised	Anonymised	2009	15.45	532382	0.07	7.54	26%	1	1.94
Anonymised	Anonymised	2006	20.18	257642	0.05	15.33	51%	1	4.64
Anonymised	Anonymised	2006	12.57	490739	0.05	7.08	23%	1	2.92
Anonymised	Anonymised	2004	20.68	216221	0.04	17.54	44%	1	5.07
Anonymised	Anonymised	2007	18.73	279178	0.03	14.59	53%	1	4.14
Anonymised	Anonymised	2006	8.48	1557775	0.02	6.00	21%	0	1.98
Anonymised	Anonymised	2002	4.23	635005	0.00	5.71	23%	1	2.58
Anonymised	Anonymised	2002	7.40	251385	0.00	5.82	32%	0	2.69
Anonymised	Anonymised	2002	43.01	43873	0.00	6.74	10%	0	2.72
Anonymised	Anonymised	2002	11.23	161223	0.00	5.75	80%	1	2.02
Anonymised	Anonymised	2002	3.83	1275529	0.00	6.76	15%	0	1.87
Anonymised	Anonymised	2002	7.71	397631	0.00	5.63	21%	0	1.65
Anonymised	Anonymised	2002	10.81	91571	0.00	11.52	35%	1	2.74

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2002	5.02	345455	0.00	7.12	21%	1	1.33
Anonymised	Anonymised	2002	8.68	202303	0.00	5.69	24%	1	6.43
Anonymised	Anonymised	2002	4.56	737292	0.00	7.59	22%	1	1.06
Anonymised	Anonymised	2002	11.61	207804	0.00	14.52	53%	1	2.63
Anonymised	Anonymised	2002	25.42	71220	0.00	6.57	25%	0	1.36
Anonymised	Anonymised	2002	30.03	86391	0.00	9.45	31%	0	9.36
Anonymised	Anonymised	2002	8.39	275488	0.00	5.74	30%	1	2.24
Anonymised	Anonymised	2002	3.42	1378285	0.00	5.46	24%	0	1.94
Anonymised	Anonymised	2003	5.46	636201	0.00	5.87	22%	1	1.92
Anonymised	Anonymised	2003	8.96	261669	0.00	5.92	32%	0	4.25
Anonymised	Anonymised	2003	41.68	42348	0.00	8.04	7%	0	2.48
Anonymised	Anonymised	2003	9.51	151316	0.00	6.01	81%	1	2.06
Anonymised	Anonymised	2003	6.58	1243170	0.00	7.47	16%	0	1.55
Anonymised	Anonymised	2003	13.18	393310	0.00	5.56	20%	0	3.59
Anonymised	Anonymised	2003	15.86	96887	0.00	10.86	30%	1	9.19
Anonymised	Anonymised	2003	7.01	376889	0.00	7.14	21%	1	2.21
Anonymised	Anonymised	2003	9.32	204779	0.00	6.19	24%	1	3.82
Anonymised	Anonymised	2003	6.27	695101	0.00	7.43	22%	1	2.10
Anonymised	Anonymised	2003	14.59	200324	0.00	15.23	49%	1	4.26
Anonymised	Anonymised	2003	33.63	47540	0.00	7.51	29%	1	8.63
Anonymised	Anonymised	2003	31.78	86475	0.00	9.54	33%	0	9.27
Anonymised	Anonymised	2003	8.85	298662	0.00	6.08	25%	1	2.57
Anonymised	Anonymised	2003	5.66	1349485	0.00	5.86	23%	0	1.77
Anonymised	Anonymised	2004	7.71	706288	0.00	7.08	20%	1	2.16
Anonymised	Anonymised	2004	8.79	1308080	0.00	8.62	15%	1	1.83

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Anonymised	Anonymised	2004	9.67	413657	0.00	9.47	22%	1	3.18
Anonymised	Anonymised	2004	8.28	769402	0.00	7.91	17%	1	2.82
Anonymised	Anonymised	2004	6.96	1447176	0.00	6.64	24%	0	2.18
Anonymised	Anonymised	2005	7.93	684366	0.00	6.84	19%	1	2.02
Anonymised	Anonymised	2005	8.74	1330302	0.00	7.92	15%	1	1.67
Anonymised	Anonymised	2005	11.47	438002	0.00	7.77	22%	1	3.14
Anonymised	Anonymised	2005	8.38	761884	0.00	8.32	19%	1	2.90
Anonymised	Anonymised	2005	18.80	239927	0.00	15.84	51%	1	4.99
Anonymised	Anonymised	2005	7.42	1460227	0.00	6.40	23%	0	2.17
Anonymised	Anonymised	2006	8.70	732835	0.00	6.39	19%	1	1.83
Anonymised	Anonymised	2006	8.91	1430721	0.00	7.22	15%	1	1.50
Anonymised	Anonymised	2006	10.00	820243	0.00	7.89	18%	1	2.85
Anonymised	Anonymised	2007	9.32	770680	0.00	6.22	18%	1	1.71
Anonymised	Anonymised	2007	9.18	1520126	0.00	6.73	14%	1	1.42
Anonymised	Anonymised	2007	10.47	877972	0.00	7.47	17%	1	2.64
Anonymised	Anonymised	2008	10.06	811317	0.00	6.56	21%	1	0.87
Anonymised	Anonymised	2008	9.83	1500394	0.00	7.02	15%	1	0.79
Anonymised	Anonymised	2008	10.08	915147	0.00	7.63	18%	1	1.52
Anonymised	Anonymised	2009	8.97	1554690	0.00	6.79	14%	1	1.00
Anonymised	Anonymised	2009	10.34	845713	0.00	7.79	16%	1	1.59
Anonymised	Anonymised	2010	10.64	833633	0.00	6.50	26%	1	1.19
Anonymised	Anonymised	2010	8.80	1612075	0.00	6.64	16%	1	1.10
Anonymised	Anonymised	2010	10.30	839949	0.00	7.68	18%	1	1.72
		min	3.42	5850	0.00	2.80	0.02	0.00	0.79
		max	247.00	1649847	1.50	25.98	0.83	1.00	142.26

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
		avg.	38.62	206035	0.52	7.91	0.23	0.74	10.50
		std.dev.	35.45	342347	0.31	2.69	0.16	0.44	15.01

Dependent and independent variables from French airports used for the spatial regression

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Ajaccio	AJA	2002	8.66	1067769.70	0.02	7.09	62%	1.00	1.69
Aurillac	AUR	2002	43.84	17685.00	0.33	7.61	92%	1.00	0.89
Brest	BES	2002	12.62	740046.60	0.05	6.77	64%	1.00	1.86
Bastia	BIA	2002	8.25	832644.50	0.02	8.03	50%	0.00	2.71
Biarritz	BIQ	2002	9.90	778799.10	0.00	10.05	68%	0.00	3.20
Beauvais	BVA	2002	12.24	681378.50	0.01	8.52	81%	1.00	2.27
Beziers-Vias	BZR	2002	21.58	67935.00	0.27	6.42	91%	1.00	4.20
CAEN-CARPIQUET	CFR	2002	15.44	138532.60	0.21	9.73	90%	0.00	5.28
CALVI-SAINTE-CATHERINE	CLY	2002	8.72	261528.80	0.50	7.06	58%	1.00	3.48
DINARD-PLEURTUIT-SAINT-MALO	DNR	2002	12.02	96873.50	0.10	8.62	89%	0.00	3.80
BERGERAC-ROUMANIERE	EGC	2002	32.07	63002.00	0.25	9.72	93%	0.00	4.15
NIMES-GARONS	FNI	2002	16.61	230586.00	0.02	7.64	73%	0.00	2.68
FIGARI,SUD-CORSE	FSC	2002	8.46	296056.00	0.22	5.58	66%	0.00	1.63
Grenoble-Isère Airport	GNB	2002	20.57	264578.10	0.20	9.38	90%	0.00	0.00
Tarbes-Lourdes-Pyrénés	LDE	2002	13.69	444284.50	0.03	7.62	80%	1.00	4.64
LIMOGES-BELLEGARDE	LIG	2002	15.72	214371.10	0.20	6.96	82%	1.00	0.12
Lille	LIL	2002	12.28	923189.20	0.02	7.65	50%	0.00	5.20
LA-ROCHELLE-ILE DE RE	LRH	2002	17.31	91854.00	0.25	8.87	91%	1.00	3.38

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
LORIENT-LANN-BIHOUE	LRT	2002	11.44	214371.40	0.05	6.12	0%	1.00	2.77
Montpellier	MPL	2002	9.60	1566494.50	0.02	7.22	71%	0.00	3.15
Marseille	MRS	2002	9.01	5784226.50	0.00	6.39	28%	1.00	4.21
Nantes	NTE	2002	9.22	1876982.20	0.04	8.49	47%	0.00	3.89
Perpignan-Rivesaltes	PGF	2002	9.16	647562.20	0.00	4.50	82%	1.00	1.96
Pau-Pyrénées	PUF	2002	13.43	585452.60	0.06	6.65	82%	1.00	2.30
Rennes	RNS	2002	11.18	377648.10	0.03	10.21	65%	1.00	11.58
Toulon-Hyères	TLN	2002	10.50	739561.90	0.00	6.85	0%	1.00	1.83
Ajaccio	AJA	2003	11.90	1067400.50	0.01	8.64	67%	1.00	1.87
Aurillac	AUR	2003	43.60	17605.00	0.36	7.64	90%	1.00	1.15
Brest	BES	2003	13.78	704431.10	0.07	7.26	65%	1.00	2.12
Bastia	BIA	2003	9.65	845387.40	0.04	8.16	62%	0.00	2.64
Biarritz	BIQ	2003	10.77	799960.10	0.00	9.99	69%	0.00	2.77
Beauvais	BVA	2003	12.74	969452.00	0.00	5.63	69%	0.00	2.07
Beziers-Vias	BZR	2003	26.20	61129.10	0.16	12.82	92%	1.00	8.17
CAEN-CARPIQUET	CFR	2003	22.13	100022.00	0.23	9.47	88%	0.00	5.62
CALVI-SAINTE-CATHERINE	CLY	2003	12.52	254556.50	0.32	6.77	58%	1.00	3.71
DINARD-PLEURTUIT-SAINT-MALO	DNR	2003	13.39	112791.60	0.23	8.74	87%	0.00	5.18
BERGERAC-ROUMANIERE	EGC	2003	23.53	116137.00	0.15	9.12	90%	0.00	2.94
NIMES-GARONS	FNI	2003	30.75	134606.00	0.11	10.68	82%	0.00	7.69
FIGARI,SUD-CORSE	FSC	2003	10.83	298348.00	0.36	5.21	64%	0.00	3.00
Grenoble-Isère Airport	GNB	2003	30.41	178516.90	0.40	9.26	91%	0.00	0.00
Tarbes-Lourdes-Pyrénés	LDE	2003	15.93	378923.00	0.10	10.23	83%	1.00	5.84
LIMOGES-BELLEGARDE	LIG	2003	18.91	207445.80	0.25	7.90	83%	1.00	0.03
Lille	LIL	2003	13.35	867560.00	0.01	8.57	50%	0.00	5.98

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
LA-ROCHELLE-ILE DE RE	LRH	2003	21.18	93802.00	0.46	9.53	92%	1.00	4.21
LORIENT-LANN-BIHOUE	LRT	2003	14.81	207445.70	0.12	6.89	3%	1.00	2.21
Montpellier	MPL	2003	11.19	1568975.00	0.01	7.55	73%	0.00	18.66
Marseille	MRS	2003	9.11	5945237.40	0.00	6.21	27%	1.00	4.16
Nantes	NTE	2003	11.18	1916454.40	0.01	8.91	50%	0.00	4.29
Perpignan-Rivesaltes	PGF	2003	13.23	470073.00	0.09	7.42	82%	1.00	3.21
Pau-Pyrénées	PUF	2003	12.54	682778.40	0.00	8.30	84%	1.00	2.03
Rennes	RNS	2003	14.39	379858.70	0.10	10.02	68%	1.00	6.82
Toulon-Hyères	TLN	2003	15.16	554760.00	0.01	9.02	0%	1.00	4.13
Ajaccio	AJA	2004	12.78	977440.70	0.23	9.04	63%	1.00	2.21
Aurillac	AUR	2004	54.05	14441.00	0.32	7.56	89%	1.00	6.48
Brest	BES	2004	14.18	700352.70	0.03	7.86	65%	1.00	1.95
Bastia	BIA	2004	10.33	835661.00	0.10	8.20	58%	0.00	2.76
Biarritz	BIQ	2004	10.96	786387.10	0.00	11.17	73%	0.00	3.62
Beauvais	BVA	2004	11.01	1427612.00	0.00	5.29	63%	0.00	4.92
Beziers-Vias	BZR	2004	48.86	34590.00	0.40	8.68	93%	1.00	9.35
CAEN-CARPIQUET	CFR	2004	22.00	102065.60	0.39	9.28	91%	1.00	5.11
CALVI-SAINTE-CATHERINE	CLY	2004	15.68	228101.80	0.52	8.62	61%	0.00	3.89
DINARD-PLEURTUIT-SAINT-MALO	DNR	2004	11.95	144017.00	0.10	7.66	87%	0.00	7.09
BERGERAC-ROUMANIERE	EGC	2004	16.68	204691.00	0.03	8.53	86%	0.00	1.48
NIMES-GARONS	FNI	2004	22.15	156582.20	0.01	8.47	87%	0.00	6.17
FIGARI,SUD-CORSE	FSC	2004	15.36	254833.00	0.54	9.32	69%	0.00	2.14
Grenoble-Isère Airport	GNB	2004	25.44	204114.00	0.15	8.78	92%	0.00	0.19
Tarbes-Lourdes-Pyrénés	LDE	2004	15.18	411097.00	0.07	9.76	82%	1.00	4.46
LIMOGES-BELLEGARDE	LIG	2004	20.20	223843.60	0.31	7.96	83%	1.00	0.07

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Lille	LIL	2004	14.37	838314.10	0.10	8.46	41%	0.00	6.32
LA-ROCHELLE-ILE DE RE	LRH	2004	23.19	100404.00	0.40	7.86	95%	1.00	2.14
LORIENT-LANN-BIHOUE	LRT	2004	15.91	198465.40	0.10	7.62	3%	1.00	1.56
Montpellier	MPL	2004	11.20	1327849.50	0.02	7.86	82%	0.00	1.09
Marseille	MRS	2004	8.77	6233812.70	0.00	6.30	26%	1.00	4.04
Nantes	NTE	2004	10.65	1898874.30	0.01	7.74	51%	0.00	3.51
Perpignan-Rivesaltes	PGF	2004	15.25	446129.00	0.30	7.56	84%	1.00	0.45
Pau-Pyrénées	PUF	2004	12.27	721234.80	0.00	8.11	83%	1.00	2.13
Rennes	RNS	2004	12.82	377127.10	0.14	9.75	72%	1.00	1.28
Toulon-Hyères	TLN	2004	17.57	527904.10	0.01	9.31	0%	1.00	3.39
Ajaccio	AJA	2005	12.84	979227.30	0.40	8.93	68%	1.00	2.51
Aurillac	AUR	2005	48.92	16878.00	0.33	8.33	89%	1.00	0.73
Brest	BES	2005	13.56	775258.30	0.00	7.70	0%	1.00	4.78
Bastia	BIA	2005	8.92	817892.40	0.36	8.45	63%	0.00	2.79
Biarritz	BIQ	2005	10.91	817090.20	0.00	10.75	75%	0.00	2.62
Beauvais	BVA	2005	12.59	1848503.60	0.00	5.49	58%	0.00	1.49
Beziers-Vias	BZR	2005	22.89	43278.00	0.70	8.41	92%	1.00	7.51
CAEN-CARPIQUET	CFR	2005	23.63	100339.00	0.61	8.97	90%	1.00	10.84
CALVI-SAINTE-CATHERINE	CLY	2005	14.62	246688.30	0.60	8.34	59%	0.00	3.32
DINARD-PLEURTUIT-SAINT-MALO	DNR	2005	11.93	179971.90	0.19	6.90	92%	0.00	3.22
BERGERAC-ROUMANIERE	EGC	2005	18.37	233760.00	0.06	8.42	89%	0.00	1.39
NIMES-GARONS	FNI	2005	18.88	206129.10	0.36	8.37	60%	0.00	4.16
FIGARI,SUD-CORSE	FSC	2005	15.00	266230.00	0.54	8.48	71%	0.00	2.08
Grenoble-Isère Airport	GNB	2005	20.77	271407.00	0.42	7.03	93%	0.00	1.05
Tarbes-Lourdes-Pyrénés	LDE	2005	15.26	462148.00	0.15	9.50	79%	1.00	3.70

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
LIMOGES-BELLEGARDE	LIG	2005	19.28	283850.30	0.35	7.12	82%	1.00	0.20
Lille	LIL	2005	15.55	842739.20	0.08	8.86	35%	0.00	6.16
LA-ROCHELLE-ILE DE RE	LRH	2005	22.03	127563.00	0.26	9.54	93%	1.00	4.10
LORIENT-LANN-BIHOUE	LRT	2005	14.51	214412.80	0.09	7.18	5%	1.00	2.27
Montpellier	MPL	2005	11.80	1311497.60	0.00	7.98	82%	1.00	4.51
Marseille	MRS	2005	8.33	6566471.80	0.00	6.15	24%	1.00	3.88
Nantes	NTE	2005	10.47	2129663.40	0.02	8.04	39%	0.00	3.15
Perpignan-Rivesaltes	PGF	2005	13.27	428987.00	0.25	8.32	83%	1.00	2.34
Pau-Pyrénées	PUF	2005	12.44	729445.80	0.00	7.92	83%	1.00	1.53
Rennes	RNS	2005	20.65	406615.80	0.10	9.56	73%	1.00	7.55
Toulon-Hyères	TLN	2005	14.34	536234.00	0.01	8.55	0%	1.00	3.38
Ajaccio	AJA	2006	12.92	985298.40	0.23	8.80	66%	1.00	5.48
Aurillac	AUR	2006	38.99	19148.00	0.36	7.18	91%	1.00	0.36
Brest	BES	2006	13.28	817620.50	0.01	7.14	66%	0.00	1.20
Bastia	BIA	2006	10.72	821560.00	0.23	8.45	63%	0.00	1.90
Biarritz	BIQ	2006	10.34	864792.00	0.00	7.53	72%	0.00	2.23
Beauvais	BVA	2006	12.68	1884992.50	0.00	5.08	63%	0.00	1.87
Beziers-Vias	BZR	2006	47.46	41987.10	0.38	9.16	50%	1.00	6.27
CAEN-CARPIQUET	CFR	2006	22.42	107006.80	0.39	8.85	90%	1.00	14.69
CALVI-SAINTE-CATHERINE	CLY	2006	13.57	270891.80	0.55	8.37	55%	0.00	1.55
DINARD-PLEURTUIT-SAINT-MALO	DNR	2006	12.99	163965.00	0.24	6.94	93%	0.00	3.94
BERGERAC-ROUMANIERE	EGC	2006	17.61	269630.00	0.07	8.31	88%	0.00	1.01
NIMES-GARONS	FNI	2006	19.39	226887.10	0.36	9.45	82%	0.00	0.81
FIGARI,SUD-CORSE	FSC	2006	13.56	302374.00	0.57	8.47	74%	0.00	7.58
Grenoble-Isère Airport	GNB	2006	17.74	432933.00	0.21	12.58	90%	0.00	0.72

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Tarbes-Lourdes-Pyrénés	LDE	2006	14.61	450547.00	0.15	9.80	79%	1.00	3.50
LIMOGES-BELLEGARDE	LIG	2006	16.70	378294.90	0.32	7.20	78%	1.00	0.00
Lille	LIL	2006	13.59	925508.80	0.05	9.14	43%	0.00	5.51
LA-ROCHELLE-ILE DE RE	LRH	2006	17.68	180980.00	0.44	8.86	92%	1.00	7.62
LORIENT-LANN-BIHOUE	LRT	2006	13.92	225174.10	0.03	7.76	0%	1.00	0.94
Montpellier	MPL	2006	10.85	1323572.30	0.00	8.34	84%	1.00	4.54
Marseille	MRS	2006	8.78	6757288.60	0.00	6.58	22%	0.00	3.55
Nantes	NTE	2006	8.80	2333522.70	0.02	7.98	42%	0.00	1.62
Perpignan-Rivesaltes	PGF	2006	12.44	448963.00	0.08	7.79	85%	1.00	1.90
Pau-Pyrénées	PUF	2006	12.33	763977.00	0.04	7.71	82%	1.00	1.77
Rennes	RNS	2006	13.46	464215.90	0.25	9.33	73%	1.00	6.05
Toulon-Hyères	TLN	2006	13.88	638810.80	0.01	8.27	0%	0.00	2.18
Ajaccio	AJA	2007	13.22	1025102.10	0.22	8.80	67%	1.00	1.59
Aurillac	AUR	2007	37.10	18620.00	0.35	7.76	93%	1.00	0.26
Brest	BES	2007	13.89	850596.10	0.01	7.26	64%	0.00	1.52
Bastia	BIA	2007	10.78	860727.30	0.25	7.80	64%	0.00	1.83
Biarritz	BIQ	2007	10.62	930880.00	0.00	7.21	72%	0.00	2.11
Beauvais	BVA	2007	11.48	2155639.50	0.00	5.08	52%	0.00	1.15
Beziers-Vias	BZR	2007	66.46	31824.00	0.44	9.33	37%	1.00	13.87
CAEN-CARPIQUET	CFR	2007	22.56	112091.80	0.41	9.36	90%	1.00	9.11
CALVI-SAINTE-CATHERINE	CLY	2007	14.04	273574.30	0.54	8.75	53%	0.00	1.68
DINARD-PLEURTUIT-SAINT-MALO	DNR	2007	11.72	178616.40	0.22	7.25	91%	0.00	4.23
BERGERAC-ROUMANIERE	EGC	2007	27.13	254429.00	0.11	8.61	86%	0.00	1.01
NIMES-GARONS	FNI	2007	24.96	225702.00	0.24	10.27	84%	0.00	0.31
FIGARI,SUD-CORSE	FSC	2007	13.54	341008.00	0.33	8.69	63%	0.00	0.00

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
Grenoble-Isère Airport	GNB	2007	18.10	469658.00	0.22	7.50	89%	0.00	2.00
Tarbes-Lourdes-Pyrénés	LDE	2007	15.05	444258.00	0.01	10.04	79%	1.00	4.28
LIMOGES-BELLEGARDE	LIG	2007	17.14	391220.30	0.27	7.68	78%	1.00	0.02
Lille	LIL	2007	13.46	1051789.90	0.05	8.57	47%	0.00	3.65
LA-ROCHELLE-ILE DE RE	LRH	2007	15.54	220577.00	0.27	8.74	90%	1.00	3.77
LORIENT-LANN-BIHOUE	LRT	2007	16.74	214622.00	0.08	8.22	9%	1.00	1.32
Montpellier	MPL	2007	11.37	1287449.80	0.00	9.04	84%	1.00	6.84
Marseille	MRS	2007	8.95	6809269.80	0.00	6.69	20%	0.00	0.00
Nantes	NTE	2007	9.93	2579193.30	0.02	7.72	36%	1.00	2.50
Perpignan-Rivesaltes	PGF	2007	13.67	422798.00	0.09	8.22	86%	1.00	2.30
Pau-Pyrénées	PUF	2007	13.15	763307.50	0.03	8.45	82%	1.00	1.64
Rennes	RNS	2007	12.05	536067.50	0.20	9.21	73%	1.00	4.95
Toulon-Hyères	TLN	2007	13.65	646053.00	0.01	8.25	0%	0.00	2.89
Ajaccio	AJA	2008	12.07	1078415.70	0.22	8.64	63%	1.00	1.51
Aurillac	AUR	2008	40.51	19059.00	0.33	7.36	92%	1.00	0.39
Brest	BES	2008	15.95	874899.70	0.08	6.93	58%	0.00	2.56
Bastia	BIA	2008	10.32	934348.00	0.00	11.11	63%	0.00	1.68
Biarritz	BIQ	2008	10.89	1027911.00	0.00	7.70	70%	0.00	1.82
Beauvais	BVA	2008	11.23	2484635.60	0.00	4.85	47%	0.00	0.44
Beziers-Vias	BZR	2008	47.87	75178.00	0.10	22.15	93%	1.00	8.52
CAEN-CARPIQUET	CFR	2008	23.64	107899.80	0.48	9.24	90%	1.00	9.18
CALVI-SAINTE-CATHERINE	CLY	2008	14.73	275860.20	0.00	16.92	53%	0.00	1.95
DINARD-PLEURTUIT-SAINT-MALO	DNR	2008	10.97	201175.20	0.04	8.54	82%	0.00	3.39
BERGERAC-ROUMANIERE	EGC	2008	19.89	294700.00	0.14	8.58	84%	0.00	1.90
NIMES-GARONS	FNI	2008	23.55	224459.00	0.30	9.80	87%	0.00	0.51

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
FIGARI,SUD-CORSE	FSC	2008	10.92	370929.00	0.33	8.72	68%	0.00	0.55
Grenoble-Isère Airport	GNB	2008	17.47	469777.00	0.01	10.15	88%	0.00	2.08
Tarbes-Lourdes-Pyrénés	LDE	2008	11.87	678897.00	0.00	9.60	68%	1.00	3.59
LIMOGES-BELLEGARDE	LIG	2008	18.67	382398.10	0.27	7.97	72%	1.00	0.07
Lille	LIL	2008	14.29	1014721.00	0.06	8.50	48%	0.00	6.01
LA-ROCHELLE-ILE DE RE	LRH	2008	16.76	215145.00	0.29	8.56	90%	1.00	3.56
LORIENT-LANN-BIHOUE	LRT	2008	16.87	217603.00	0.08	8.56	16%	1.00	0.94
Montpellier	MPL	2008	11.20	1256912.50	0.00	8.50	82%	1.00	1.88
Marseille	MRS	2008	9.78	6971334.20	0.00	6.84	21%	0.00	3.85
Nantes	NTE	2008	9.01	2732469.50	0.02	7.39	31%	1.00	3.29
Perpignan-Rivesaltes	PGF	2008	12.40	522765.00	0.01	6.79	88%	1.00	1.33
Pau-Pyrénées	PUF	2008	12.92	817769.40	0.00	8.16	78%	1.00	1.42
Rennes	RNS	2008	14.67	497534.10	0.23	8.94	76%	1.00	4.72
Toulon-Hyères	TLN	2008	13.98	629596.30	0.00	8.07	0%	0.00	2.47
Ajaccio	AJA	2009	12.83	1090343.50	0.23	8.85	60%	1.00	1.79
Aurillac	AUR	2009	39.40	20501.00	0.23	13.79	91%	1.00	0.14
Brest	BES	2009	14.88	881639.30	0.01	8.14	71%	0.00	2.38
Bastia	BIA	2009	10.09	1012455.40	0.00	10.96	63%	0.00	1.42
Biarritz	BIQ	2009	11.68	1011589.00	0.01	7.65	72%	0.00	2.09
Beauvais	BVA	2009	11.29	2591864.00	0.00	4.94	43%	0.00	0.55
Beziers-Vias	BZR	2009	22.58	86816.00	0.04	4.76	96%	1.00	7.23
CAEN-CARPIQUET	CFR	2009	29.07	90033.60	0.45	9.74	86%	1.00	5.43
CALVI-SAINTE-CATHERINE	CLY	2009	14.87	286274.30	0.00	17.02	55%	0.00	1.48
DINARD-PLEURTUIT-SAINT-MALO	DNR	2009	15.80	136943.10	0.03	12.52	84%	0.00	5.20
BERGERAC-ROUMANIERE	EGC	2009	19.15	274658.00	0.19	7.79	85%	0.00	0.83

Airport	IATA	Year	costppax	wlu	subs	aerrev	noncommatm	pso	deprppax
NIMES-GARONS	FNI	2009	24.88	182867.00	0.09	11.10	88%	0.00	0.73
FIGARI,SUD-CORSE	FSC	2009	10.36	401611.00	0.24	8.71	61%	0.00	0.58
Grenoble-Isère Airport	GNB	2009	20.04	456062.00	0.31	8.02	89%	1.00	1.29
Tarbes-Lourdes-Pyrénés	LDE	2009	14.74	481004.00	0.05	9.27	68%	1.00	0.96
LIMOGES-BELLEGARDE	LIG	2009	20.16	356353.10	0.36	8.37	80%	1.00	0.08
Lille	LIL	2009	12.12	1147925.40	0.00	8.41	38%	0.00	0.80
LA-ROCHELLE-ILE DE RE	LRH	2009	19.12	168969.00	0.22	9.15	91%	1.00	4.58
LORIENT-LANN-BIHOUE	LRT	2009	18.49	187754.00	0.07	9.59	12%	1.00	1.61
Montpellier	MPL	2009	12.13	1225690.20	0.00	9.63	84%	1.00	3.78
Marseille	MRS	2009	8.82	7295964.10	0.00	6.88	22%	0.00	3.78
Nantes	NTE	2009	9.62	2668437.30	0.01	7.88	31%	1.00	2.89
Perpignan-Rivesaltes	PGF	2009	14.99	393275.00	0.07	8.70	89%	1.00	1.53
Pau-Pyrénées	PUF	2009	19.20	691187.80	0.00	9.55	81%	1.00	2.50
Rennes	RNS	2009	15.62	431968.80	0.25	9.89	77%	1.00	5.20
Toulon-Hyères	TLN	2009	17.76	576739.60	0.00	8.53	0%	0.00	3.58
		min	8.25	14441	0.00	4.50	0%	0.00	0.00
		max	66.46	7295964	0.70	22.15	96%	1.00	18.66
		avg.	16.67	826325	0.15	8.45	66%	0.53	3.21
		std.dev.	8.89	1274584	0.16	1.90	26%	0.50	2.70

Geographic coordinates of Norwegian and French airports

Country	Airport	IATA	Latitude	Longitude
France	Ajaccio	AJA	41.916667	8.8
France	Aurillac	AUR	44.891667	-2.416667
France	Brest	BES	48.45	-4.416667
France	Bastia	BIA	42.7	9.45
France	Biarritz	BIQ	43.466667	-1.533333
France	Beauvais	BVA	49.45	2.116667
France	Beziers-Vias	BZR	43.323333	3.353333
France	CAEN-CARPIQUET	CFR	49.183333	-0.45
France	CALVI-SAINTE-CATHERINE	CLY	42.533333	8.8
France	DINARD-PLEURTUIT-SAINT-MALO	DNR	48.583333	-2.083333
France	BERGERAC-ROUMANIERE	EGC	44.833333	0.516667
France	NIMES-GARONS	FNI	43.85	4.416667
France	FIGARI,SUD-CORSE	FSC	41.583333	9.25
France	Grenoble-Isère Airport	GNB	45.363056	5.332778
France	Tarbes-Lourdes-Pyrénés	LDE	43.181944	0.000278
France	LIMOGES-BELLEGARDE	LIG	45.860833	1.180278
France	Lille	LIL	50.566667	3.1
France	LA-ROCHELLE-ILE DE RE	LRH	46.5	-1.5
France	LORIENT-LANN-BIHOUE	LRT	47.766667	-3.45
France	Montpellier	MPL	43.583333	3.966667
France	Marseille	MRS	43.436667	5.215
France	Nantes	NTE	47.15	-1.6
France	Perpignan-Rivesaltes	PGF	42.740833	2.869722

Country	Airport	IATA	Latitude	Longitude
France	Pau-Pyrénées	PUF	43.38	-0.418611
France	Rennes	RNS	48.066667	-1.733333
France	Toulon-Hyères	TLN	43.097222	6.146111
Norway	Ålesund	AES	62.560278	6.1
Norway	Alta	ALF	69.983333	23.366667
Norway	Andøya	ANX	69.316667	16.116667
Norway	Bardufoss	BDU	69.055833	18.540278
Norway	Båtsfjord	BJF	70.633333	29.5
Norway	Brønnøysund	BNN	65.483333	12.216667
Norway	Bodø	BOO	67.266667	14.366667
Norway	Berlevåg	BVG	70.866667	29
Norway	Evenes (Harstad-Narvik)	EVE	68.5	16.683333
Norway	Førde	FDE	61.391111	5.756944
Norway	Florø	FRO	61.5	5.083333
Norway	Hasvik	HAA	70.483333	22.033333
Norway	Haugesund	HAU	59.416667	5.3
Norway	Hammerfest	HFT	70.7	23.666667
Norway	Ørsta-Volda	HOV	62.2	6.15
Norway	Honningsvåg	HVG	70.983333	25.833333
Norway	Kirkenes	KKN	69.716667	29.9
Norway	Kristiansand	KRS	58.2	8.1
Norway	Kristiansund	KSU	63.116667	7.85
Norway	Banak (Lakselv)	LKL	70.05	24.983333
Norway	Leknes	LKN	68.15	13.016667
Norway	Svalbard	LYR	78.191667	15.9

Country	Airport	IATA	Latitude	Longitude
Norway	Mehamn	MEH	71.033333	27.833333
Norway	Mosjøen	MJF	65.783333	13.216667
Norway	Molde	MOL	62.744722	7.2625
Norway	Mo i Rana	MQN	66.316667	14
Norway	Narvik	NVK	68.425	17.425
Norway	Namsos	OSY	64.466667	11.6
Norway	Røst	RET	67.483333	12.083333
Norway	Røros	RRS	62.583333	11.35
Norway	Rørvik	RVK	64.85	11.233333
Norway	Sandane	SDN	61.766667	6.216667
Norway	Stokmarknes	SKN	68.583333	15.016667
Norway	Sogndal	SOG	61.166667	7.133333
Norway	Sørkjosen	SOJ	69.783333	20.933333
Norway	Sandnessjøen	SSJ	65.95	12.466667
Norway	Svolvær	SVJ	68.233333	14.55
Norway	Tromsø	TOS	69.681389	18.917778
Norway	Vardø	VAW	70.355278	31.045
Norway	Fagernes	VDB	61.083333	9.333333
Norway	Vadsø	VDS	70.066667	29.75

Selbständigkeitserklärung

Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie über frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entsprechen.

Berlin, den 16.06.2014 Tolga Ülkü